Underground Gas Storage in Seamless Steel Bottles

Gas stored underground in USS NATIONAL Seamless Steel Bottles is safe from harm—immune from storms, lightning, and high winds. Moreover, there is no hazard to or from aviation.

Buried underground, NATIONAL Seamless Steel Bottles offer enormous possibilities to utility companies for future high pressure gas storage for both emergency and peak loads. Just fifty of these Steel Bottles, each averaging 39 feet 3 inches in length and 24 inches in diameter, will hold 1¼ *million cubic feet* of gas at 2240 p.s.i. A recent installation of 2800 bottles stored 70,000,000 cubic feet of gas.

Once installed in the ground, storage bottles will not vibrate or settle as a surface installation will. Nor does the gas pressure fluctuate as it would above ground, since underground temperatures remain relatively stable the year round.

Underground gas storage is economical. Unlike surface installations, steel bottles do not have to be painted periodically, nor do they require constant inspection and protection against the weather. When necessary, however, any group of bottles may be taken off the line without interrupting the gas pressure or flow from the other groups.

Each NATIONAL Seamless Steel Bottle is pierced from a solid billet of high quality steel, a process which eliminates any doubt about wall strength. Furthermore, every bottle is hydrostatically tested before it leaves the factory, insuring the utmost in strength and safety.

To further investigate the possibilities of underground gas storage, write National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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NATIONAL SEAMLESS STEEL BOTTLES

UNITED STATES STEEL

GAS

30th Year of Publication

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BPA

Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

Southern California to be everyman's mecca next October

GAMA, which had originally planned to meet in Los Angeles next May, is now reportedly scheduling its annual convention in Palm Springs Oct. 12-14, the week prior to the AGA convention in Los Angeles. And Pacific Coast Gas Association, which traditionally meets in September, has decided to combine with AGA, briefing down its regular program to a minimum.

Western gas salesmen going back to school

In cooperation with the manufacturers section of PCGA, the University of Southern California has inaugurated an eight-week evening training course for gas appliance salesmen. The classes are being organized and conducted by the university under the direct supervision of its instructors, but appliance manufacturers and utility men will participate as guest lecturers. The course is open to men or women who sell appliances.

"Operation Snowflake" looks like a blizzard

U. S. Steel predicts that its big promotion for major household appliances will make them the top sellers as Christmas gifts this year. All major gas, electric, and appliance associations are behind it, as are nearly all manufacturers who buy from U. S. Steel. Caloric, ConEd, Hamilton, and Magic Chef are among companies on the bandwagon. More than 75 utilities are participating.

Last hope expires for overturn of Phillips decision

The Supreme Court on Oct. 14 denied petitions for rehearing of its decision of June 7 declaring Phillips a "natural gas company." Thus, the only recourse now possible is Congressional action.

United Gas to enter petrochemicals field

Together with Electric Bond & Share Co. and National Research Co. of Boston, United Gas Corp. is planning to establish a new company, Gulf Chemical Co., to manufacture industrial and agricultural chemicals. Bond & Share and United would each own 40% of the $26.8 million company, with National Research holding the rest, according to a plan filed with SEC. Principal facility would be a $22.9 million plant near Pensacola, Fla. For the past five years, National Research has engaged in a petrochemicals study for the other two firms.

Gigantic rate increase sought by El Paso Natural

Already collecting under bond a $15.3 million increase, El Paso Natural Gas Co. is now asking FPC for an additional $18.1 million rate markup. Twenty-nine wholesale customers in Arizona, New Mexico, California, and Texas would be affected.

Panhandle trying to block American Louisiana construction

"Monopolistic" and "financing and supplies in doubt" were charges leveled by Panhandle Eastern Pipe Line Co. at American Louisiana Pipe Line Co. in a petition urging FPC to rehear the case. The commission had awarded American a conditional certificate for its $130 million Louisiana-to-Michigan line Oct. 1, barely within the contract deadline (see Pipeline Section). Final approval would force Panhandle into the position of a "standby source for Michigan Consolidated," says Panhandle. The American Natural Gas System (American's parent) in effect prevented Panhandle from filing a competing application (at substantial savings to consumers, said Panhandle) "because the subsidiary companies were unwilling to buy from Panhandle except on their terms of pre-empting wholesale markets in an area where they do not even hold a franchise," the petition charged.

Toronto begins receiving gas from across border

Conversion of appliances was due to start throughout the Consumers Gas Co. system Nov. 1 as the first deliveries of natural gas began through the Niagara crossing. Eventually, through a tie-in, Trans-Canada will serve the area.

September upturn reported in gas appliance shipments

With furnaces leading the way with a 26% gain, September shipments of central heating equipment recorded a 19.6% increase over the corresponding 1953 month, says GAMA. It was the best September since 1950. Range shipments were looking somewhat better, although the month's total of 204,200 units was still 2.5% off last year's mark. Year to date, range shipments lag 10.7% behind 1953.

Matters for Management

Where do the utilities stand?

In the bitter, acrimonious tussle that has developed between producer and regulatory body as a result of the recent Phillips decision that took FPC authority right back to the gathering system, where do the distributing utilities stand?

For the most part, for the record, they have adhered to the role of spectators. But are they? In a blunt challenge

Thermally Thinking

delivered before the AGA convention in Atlantic City last month, K. S. Adams, chairman of Phillips, laid the blame for the situation right at their doors. Utilities, he said, had the opportunity to present the facts to their customers and forestall the wave of public opinion that led former President Truman to veto the Kerr bill. More than that, he charged, "several of your companies were in the forefront opposing this legislation."

"You apparently overlooked the devastating result on your gas supplies and were blinded by your anxiety to remove the onus of higher consumer charges. Whatever the reason, the failure to tell your customers the facts killed that opportunity to protect your future gas supply. They needed the facts to refute the false propaganda. Will you, by your silence or opposition again, permit so few to mislead so many?"

On the matter of rate increases, too, Mr. Adams held the distributors accountable.

"Not only did you oppose or fail to support this legislation, you have arbitrarily opposed the transmission companies' payment of any increased prices to producers which were essential to protect your future gas supply.Spurred by your desire to avoid unfavorable publicity regarding your own rate increases, you have indirectly been fighting every producer who supplies you with your life blood. Is it not wiser for you to protect your future gas supplies by conducting an educational campaign to inform your consumers as to just what is involved in assuring their continuing natural gas supply? Give them the complete and correct story—immediately, forcefully and incessantly. Then they can intelligently protect their interests as the issue comes before Congress."

Most customers, Mr. Adams declared, do not know "what really comprises their gas rates. I doubt that 5% of your household customers have any idea that the price the producer receives for his gas in the field is actually a very small part of their bills — on the average less than 10%. Your customer probably has no idea that even if a regulating agency cut the field price 20%, and all that cut were passed on to him, the average United States residential consumer would realize a saving of only about one dime a month. He has no idea that that small difference to him is a big item to the producer and probably would be the determining factor as to whether or not the producer would supply his market.

"The consumer needs to know the facts as to his own bill. For example, in Milwaukee the average residential user paid $1.21 per thousand cubic feet for gas which cost the distributor 31.8 cents and for which the pipeline paid the producer only 8.7 cents. Your New York customer might be astonished to know that according to latest available figures only about 3% of his gas cost goes back to producers as payment for their costs and financial risks in supplying him gas.

"These facts make clear that any appreciable reduction in the supply of gas you handle — sure to come under federal regulation of producers — will raise the consumer's gas price far more than he could realize as savings from a drastic cut in the field price. His hope for any sizable reduction in his gas cost lies in having a greater supply moving through your distribution systems.

"It is my guess that many of you have hesitated to tell your customers such facts, fearing their reactions to the knowledge that your charges make up most of their bill. This fear is groundless, for you have nothing to hide. Because your business is a public utility, your local or state regulatory agency protects your customers by limiting your rates according to your earnings. You have everything to gain by informing your customers of the facts; you stand to lose everything if they are not sufficiently informed to demand Congressional action which will remove this threat to their gas supply and their pocketbooks."

What, Mr. Adams, is liable to happen to their gas supply?

"There is now in the process of building within these major gas producing states the greatest industrial empire ever seen in this country. The great variety of plants represented require almost unbelievable quantities of natural gas for heat, or power, or as a raw material for petrochemicals. Phillips sells more gas to just one of these plants than is used by all the residential customers in almost any one of your larger cities. Those who fought for federal regulation of producers helped lay the cornerstone of this vast manufacturing empire. This industrial giant is yet a baby, but to those who have not nursed it along and seen it grow, its magnitude and its future stature are beyond imagination.

"These plants require huge investments running into the millions of dollars. To protect these investments vast underground gas reserves are acquired for future use and removed from any market. A cement mill must have adequate rock quarries, or a saw mill adequate stands of timber. But the chemical plants that use gas require reserves sufficient not only for the life span of present facilities, but adequate also for future expansion. These industries are eager competitors for unsold underground gas reserves which otherwise might be permanently dedicated to supplying interstate pipelines.

"This industrial development in the Southwest is costing citizens of other areas huge loss of industrial activity, despite crusading campaigns to attract new or hold present industries, such as the current campaign being waged by New England. It is entirely feasible to locate many of these plants at the end of interstate gas pipelines, but for one factor. That factor is the complete lack of assurance of a continuing gas supply."

There you have it, straight from a leading producer. There is no gainsaying the threat; but is not the head of this fabulously booming concern displaying an unbecoming bit of naivete in assuming that distributing gas utilities can so easily sway their customers? Has Mr. Adams never sat in on a strictly *local* rate hearing? Has the utility but to speak in order to get the customer to listen?

Indeed, are all the utilities convinced? Obviously not. When, at the far end of the line, they can see city gate prices bumping up against high-Btu manufactured gas costs, with no assurance of what tomorrow's price will be, is their skepticism entirely unwarranted?

If completely regulated producer prices are not the answer, who's to say that completely unregulated prices are

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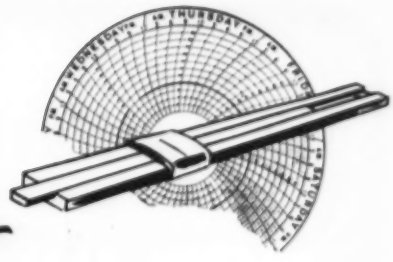
Technical Trends



• By GUY CORFIELD

Leak detection with radioactive argon-41

It is reported that radioactive argon-41 is being used for the first time to trace natural gas seepage from Kankakee, Ill., storage reservoirs operated by Peoples Gas Light & Coke Co. of Chicago. The argon is being activated at Argonne National Laboratories, in capsules, and lowered down into the gas wells by cables and there released. Tests at the surface will be made by Tracerlab, primarily at the wellheads, as it is believed that the leakage is coming from the wells rather than from the surrounding terrain.

This is the first time, as far as this writer is aware, that radioactive materials will have actually been used as tracers for the source of natural gas leakage. Such use has been discussed frequently, and technical papers on the subject have been presented at AGA meetings, but heretofore the cost has appeared to be excessive for underground reservoir work or, for that matter, for tracing distribution gas; and also, for distribution leak surveys, there would seem to be problems of public and health authority education before widespread gas treatment could be attempted.

Helium has been used successfully by the U. S. Bureau of Mines for tracing the migration of underground gas in the Elk Hills Government petroleum reserve area in California, being injected into certain wells from high pressure cylinders and its presence then checked in surrounding wells by means of adsorption partial-pressure apparatus. Its presence in gas in very low concentration can also be determined readily by mass spectrometer, and Consolidated Engineering Corp., Pasadena, Calif., has developed a portable mass spectrometer for this purpose. Leakage tracing in a distribution system, using this method, has been done experimentally in California. Acetylene has also been used successfully, in natural gas distribution and transmission systems, to determine the source of leakage when two or more underground lines are involved. It can be injected in small enough amounts, and detected in trace quantities by simple chemical test, to provide an economical procedure in many situations where the origin or movement of the gas is in doubt.

Trade association research

Trade association research is keeping up with the general high volume and level of overall industrial research, which is so evidently flourishing and expanding as indicated by the continuing announcements of new and enlarged facilities. There are about 12,000 industrial trade associations and 800 of them, at either the national or regional level, are financing scientific or technical research in some manner. About 50 of these 800 have established their own laboratory facilities and therefore have direct control and execution of at least a part of their research. An increasing number are taking their problems to organizations such as Midwest Research Institute, Stanford Research Institute, Arthur D. Little Inc., Armour Research Foundation, Battelle Memorial Institute, etc. Many invest their association funds in college and university scholarships and fellowships. Some may have their work done in individual member's laboratories, where special facilities exist.

Most administer and guide their research and interpret the results through committees organized for the purpose. While there is, of course, a great variety in type, extent, organization, financing and application of this trade association research, it has the common aim of maintaining or improving the industry's competitive position, and is generally applied to problems of overall importance that cannot be handled adequately or economically by individual members.

It is interesting and gratifying to note that our gas industry research program stands out strongly in this national picture, actually including in its pattern practically all the expedients adopted by industry in general.

Fire resistance of magnesia heat insulation

Tests recently conducted by the Magnesia Insulation Manufacturers Association indicated rather amazing resistance of 85% magnesia to penetration of heat from direct flame impingement. The test assemblies consisted of 6-ft lengths of empty 3-in. standard steel pipe, suspended horizontally, covered with 1 in. of 85% magnesia insulation with various types of material such as canvas, aluminum and galvanized steel. Thermocouples were attached to the outside surface of the pipe, under the insulation. A manufactured gas compressed air burner with the ports 10 in. below the outside bottom of the insulation was used to direct flame against and around the pipe, the flame temperature being measured by a thermocouple located 1 in. below the insulation and maintained during the tests at 2000° F.

Tests were run for a two-hour period at the end of which time, for the canvas-jacketed samples, the bottom thermocouple next to the pipe registered 593° F and the top one 501° F. The insulation remained intact and showed no damage beyond slight surface cracks. Slightly higher temperatures were obtained with metal-jacketed assemblies.

These tests are taken as an indication that pipelines, flues, ducts, etc., insulated with 85% magnesia will be protected from fire damage, and sudden rise of temperature of the contents of pipes and vessels will also be prevented.

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PERMA-SEAL CORROSION CONTROL SLEEVES
and LEAK CLAMPS

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Now in actual service for over a year, these new methods will relieve many of the problems in the gas industry. WRITE FOR FURTHER INFORMATION AND PRICE LISTS.

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GAS exclusive

The gas industry has approved its new safety code

By **F. A. HOUGH, Vice President** • Southern Counties Gas Co., Los Angeles

ACTIONS disclose intent and purpose much more than do words. The gas industry by its *actions* during the past two and one-half years has clearly demonstrated the great importance that it assigns to adequate and proper industry safety standards.

As all readers of *GAS* Magazine know, the gas industry and related industries have been spending a great deal of time, money, and effort in the development of a revised safety code covering gas transmission and distribution facilities. This project was started at the request of the American Gas Association and has been financed by that association. A substantial contribution to a related research project on pipeline pipe has been made by the major pipe manufacturing companies and the AGA. The fitting manufacturing industry, pipe fabricators, pipeline contractors, the insurance industry, and consulting engineering firms have all taken an active part in the development of the revised code. The work of developing the code has been done by an American Standards Association committee, ASA B31, Subcommittee 8, and the new code will be published as an American Standard Code by the American Society of Mechanical Engineers, which is the sponsoring society.

Mr. Hough, as chairman, and the members of ASA Subcommittee 8 on gas transmission and distribution piping have spent much time and effort since May 1952 to get the code completed and approved.

As this is being written, it appears that all necessary approvals of the code will soon be forthcoming and that it can be published in December 1954. Subcommittee 8 and the utility company members of the American Gas Association have approved the latest draft of the code by a very decisive vote. In view of the results of these two ballots, it is expected that formal approval by the AGA, the ASA, and the ASME will be given without delay.

This is the first comprehensive code covering the design, construction, operation, and maintenance of gas transmission and distribution facilities that the gas industry in the United States has had. This code, like all codes of its type, is intended to be a statement of what is generally considered to be good practice in the industry; consequently, many companies will undoubtedly find that most of their current practices conform to the new code. However, I expect that practically every gas transmission and distribution company will find it desirable in the light of this new code to change some of its practices and to adopt new practices which will contribute to improved public safety.

The new code has been developed with the idea in mind that it can, if necessary, be adopted by reference by government agencies having jurisdiction over gas transmission and distribution facilities. By providing a suitable and adequate standard code for this purpose, the industry hopes to avoid having to live under a multiplicity of non-standard state and federal codes, each different from the others and some perhaps ineffective or unduly burden-

some. However, this has not been the primary objective of the project. The primary objective has been to make a major contribution to the improvement of public safety as it is affected by gas transmission and distribution facilities by ferreting out the causes of failures of such facilities and setting down for the guidance of the industry, procedures and methods which will tend to reduce the frequency of such failures. Compliance with the new code in good faith will accomplish just this. The benefits to be derived by the industry from this activity will be found in a reduction in accidents and failures and the very important improvements in public relations and public acceptance of our product that will come as a result.

There are compelling reasons why all companies in the industry will want to comply with this code regardless of its ultimate legal status. In my opinion the greatest benefit to the industry and to the public will come if the industry is left free to comply with the code on a voluntary basis. If this is done, operations under the code will be less cumbersome and the industry will be free to make improvements in the code as new materials become available or new information is developed. The industry through operation of its appliance testing laboratories has already demonstrated in a striking way that it can regulate itself effectively in matters affecting public safety.

I hope that the American Gas Association and the regional gas associations will continue to sponsor research having as its primary objective the improvement of the safety of its facilities, and that these associations will continue to sponsor programs and reports that will sustain a high degree of safety consciousness and an awareness of the importance of the industry's practices affecting public safety. The industry's code committee should remain an active and alert committee that will revise or supplant the code frequently as experience operating under it and as new equipment, materials and methods make revision desirable.

For those who have not seen preliminary drafts of the proposed code, a discussion of some of its important provisions is presented in the accompanying box. Many limitations and exceptions to the application of these provisions are set forth in the code but cannot be repeated here for lack of space and time.

It will be noted in the box that provision is made for retroactive application of the code.

Design, construction and testing provisions of the code which produce an improvement in safety commensurate with their cost when applied at the proper time during the design or construction of a facility would usually impose a cost out of all proportion to the benefits derived, if an attempt were made to apply the same provisions to existing installations. This is a fact generally recognized by building officials and others charged with the development of building codes and similar codes concerned with public safety.

It is expected that Subcommittee 8 will remain an active committee for the purpose of providing answers to questions raised concerning the intent of the code, and to revise the code as experience with its use and as new developments require.

The American Standards Association has a systematic procedure for handling inquiries. All requests for interpretations or suggestions for revision should be addressed to the Secretary, ASA Committee B31, 420 Lexington Ave., New York 17, or to that committee in care of the ASME, 29 W. 39th St., New York 18. In either case the request will be routed to the proper committee or individual for preparation of a reply.

Requests for interpretations or changes in the code for clarification can usually be acted upon promptly. Requests for basic changes in the code or questions that disclose the need for basic changes require more time. When an approved reply to an inquiry involves a change in the code rules, the ruling is made public through the issuance of a case. This is published in "Mechanical Engineering" and also issued to all subscribers to the ASME Piping Code Interpretation Service. Other changes are usually handled by issuing revisions to the code once each year. Suggestions for revisions may originate within the committee itself or from anyone outside the committee. The ASME maintains a revision and interpretation service pertaining to the Code for Pressure Piping. The current annual fee is $2 and it is recommended that users of the code subscribe to this service as the most effective means of keeping up to date.

It is expected that the new code will be published in December and it can be obtained by placing orders with the ASME. The price per copy has not yet been established.

A discussi

1. Qualification of materials and equipment. All materials and equipment entering into gas transmission and distribution facilities must be qualified as to their safety for the conditions under which they are to be used. In the case of major items, such as pipe and fittings, this can be accomplished by using items that conform to approved specifications listed in the code. Items for which no standard specifications are listed in the code may be qualified by procedures set forth in the code which are simple or complicated depending upon the importance of the item from the standpoint of safety and the type of service it is to be in.

2. Welding. The code contains a chapter on welding, which covers preparations for welding, qualification of welding procedures and welders, and the inspection and testing of welds. Both distribution system and transmission pipeline welding are covered. The importance of proper welding procedures and adequate quality control when welding high strength pipe for high pressure service is emphasized. The importance of preheating and/or stress relieving under specified conditions is emphasized. In general, the welding requirements correspond closely to those in the new Section 6 of the Pressure Piping Code, which in turn are carefully coordinated with Section 9 of the ASME Boiler and Pressure Vessel Code. API Standard 1104, "A Standard for Field Welding of Pipelines," is acceptable under the code as a field welding specification, if the options in that specification are properly specified in accordance with the code.

3. Fabrication details. A chapter devoted to this subject covers flanges, bolting, gaskets, fittings, valves, branch connections, and special components fabricated by welding. A greatly amplified and improved section on branch connections is given. There are also new sections on expansion and flexibility, and on supports and anchors. The importance of providing adequately for the relative movement of underground pipelines in the design of interconnections between such lines is emphasized.

4. Pipeline design. Pipeline design procedures prescribed in the new code are similar to the design requirements of the code that is now in effect in that design is based upon the specified minimum yield strength of the pipe rather than upon the ultimate strength, and upon nominal wall thickness rather than minimum pipe wall thickness. The maximum stress level permitted for pipelines in rural and thinly populated areas is the same in the new code as in the old, namely 72% of the specified minimum yield strength of the pipe. At this point, however, the similarity ceases. In the new code, design is based on four location classes. Classification of locations is based on the density of population along the route of the pro-

some important provisions in the code

posed pipeline. A specific method for determining this density is prescribed by the code. These four location classes encompass the entire range from remote, sparsely settled locations on one hand to big city streets on the other. A maximum design stress is prescribed for each location class, the highest being 72% of the specified minimum yield strength and the lowest being 40% of the specified minimum yield strength.

The maximum working pressure of a pipeline is also limited to a specified percentage of the pipe mill test pressure, and this sometimes becomes the controlling factor. The code prescribes that fabricated assemblies, such as mainline valve assemblies, shall be designed for a lower hoop stress than 72% in all cases.

While the provisions of the new code relating design to location of the pipeline differ widely from the existing code, designs based on the new code come closer to conforming to the designs actually used by pipeline companies in recent years than would a design based upon a literal interpretation of the existing code.

5. Installation. The code stresses the importance of adequate inspection during construction. It emphasizes the importance of avoiding scratches and gouges in highly stressed pipelines and prescribes that when such defects are found, they shall be removed. The field repair of such defects is not permitted.

6. Requirements for testing after construction. In general the code requires that all transmission and distribution piping be tested after installation and before being placed in service. If the operating pressure is to exceed 100 psi, both a leak test and a test to demonstrate structural adequacy are required. If the operating pressure is to be below 100 psi, only a leak test is required.

In rural and sparsely populated areas the test to demonstrate structural adequacy may be with gas or air to 110% of the maximum working pressure, or with water to at least 110% of the maximum working pressure.

In fringe areas around towns and cities no gas testing is permitted. In such locations an air test to 125% of the maximum working pressure or a water test to at least 125% of the maximum working pressure is prescribed.

In towns and cities hydrostatic testing is prescribed in all cases where a hoop stress exceeding 30% of the specified minimum yield strength is required during the test. In such locations the minimum test pressure is 1.4 times the maximum operating pressure. Since distribution piping is usually stressed to much less than 30% of the specified minimum yield strength, hydrostatic testing of distribution mains and services is rarely required under the code.

The code prescribes that in all cases the testing be done with due regard for the safety of employees and the public during the test. It requires that in all cases where air or gas is used as the test medium "steps shall be taken to keep persons not working on the testing operations out of the testing area during the period in which the hoop stress is first raised from 50% of the specified minimum yield strength to the maximum test stress, and thereafter until the pressure is reduced to the maximum working pressure."

7. Cast iron pipe. Design requirements for cast iron mains and services conform generally to the requirements of ASA A21.1, A21.3, A21.7, and A21.9.

8. Compressor stations. Compressor station, construction, operation and maintenance items affecting safety are covered by the code. Subjects covered include location of site, provisions for escape from fenced areas, electrical facilities, corrosion control, liquid removal ahead of compressors, fire protection, emergency shutdown facilities, engine over-speed stops, over-pressure protection devices, building ventilation, and design of high pressure gas piping.

9. Pipe-type and bottle-type holders. The code prescribes that all holders of these types be installed underground. It prescribes permissible stress levels depending upon the location of the facility, clearance between containers, and distances they are located from property lines.

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g. Qualifying a High-Pressure Distribution System for a New and Higher Maximum Allowable Operating Pressure.

h. Control and Limiting of Gas Pressure in Low-Pressure Distribution Systems.

i. Maximum Allowable Operating Pressure for Low-Pressure Distribution Systems.

j. Conversion of Low-Pressure Distribution Systems to High-Pressure Distribution Systems.

k. Control and Limiting of the Pressure of Gas Delivered to Domestic and Small Commercial Customers from High-Pressure Distribution Systems.

l. Requirements for Design of All Pressure Relief and Pressure Limiting Installations.

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12. Vaults. Vaults above a specified size housing pressure regulating equipment are required by the code to be ventilated. It is also required that they be of adequate size to permit proper installation and maintenance of equipment.

13. Operating and maintenance procedures. The code prescribes that each operating company having gas transmission or distribution facilities within the scope of the code shall:

a. Have a plan covering operating and maintenance procedures in accordance with the purpose of this code.

b. Operate and maintain its facilities in conformance with this plan.

c. Keep records necessary to administer the plan properly.

d. Modify the plan from time to time as experience with it dictates and as exposure of the public to the facilities and changes in operating conditions require.

Some essential items to be included in the plan are listed for each type of facility, such as pipelines, distribution systems, compressor stations, bottle-type holders, and pressure limiting and pressure regulating facilities, valves, and vaults.

14. Retroactive application. The subcommittee's intent concerning the retroactive application of the code can be best stated by quoting from the code:

"It is *not* intended that this code be applied retroactively to existing installations insofar as design, fabrication, installation, established operating pressure and testing are concerned. It is intended, however, that the provisions of this code shall be applicable to the operation, maintenance, and uprating of existing installations."

some. However, this has not been the primary objective of the project. The primary objective has been to make a major contribution to the improvement of public safety as it is affected by gas transmission and distribution facilities by ferreting out the causes of failures of such facilities and setting down for the guidance of the industry, procedures and methods which will tend to reduce the frequency of such failures. Compliance with the new code in good faith will accomplish just this. The benefits to be derived by the industry from this activity will be found in a reduction in accidents and failures and the very important improvements in public relations and public acceptance of our product that will come as a result.

There are compelling reasons why all companies in the industry will want to comply with this code regardless of its ultimate legal status. In my opinion the greatest benefit to the industry and to the public will come if the industry is left free to comply with the code on a voluntary basis. If this is done, operations under the code will be less cumbersome and the industry will be free to make improvements in the code as new materials become available or new information is developed. The industry through operation of its appliance testing laboratories has already demonstrated in a striking way that it can regulate itself effectively in matters affecting public safety.

I hope that the American Gas Association and the regional gas associations will continue to sponsor research having as its primary objective the improvement of the safety of its facilities, and that these associations will continue to sponsor programs and reports that will sustain a high degree of safety consciousness and an awareness of the importance of the industry's practices affecting public safety. The industry's code committee should remain an active and alert committee that will revise or supplant the code frequently as experience operating under it and as new equipment, materials and methods make revision desirable.

For those who have not seen preliminary drafts of the proposed code, a discussion of some of its important provisions is presented in the accompanying box. Many limitations and exceptions to the application of these provisions are set forth in the code but cannot be repeated here for lack of space and time.

It will be noted in the box that provision is made for retroactive application of the code.

Design, construction and testing provisions of the code which produce an improvement in safety commensurate with their cost when applied at the proper time during the design or construction of a facility would usually impose a cost out of all proportion to the benefits derived, if an attempt were made to apply the same provisions to existing installations. This is a fact generally recognized by building officials and others charged with the development of building codes and similar codes concerned with public safety.

It is expected that Subcommittee 8 will remain an active committee for the purpose of providing answers to questions raised concerning the intent of the code, and to revise the code as experience with its use and as new developments require.

The American Standards Association has a systematic procedure for handling inquiries. All requests for interpretations or suggestions for revision should be addressed to the Secretary, ASA Committee B31, 420 Lexington Ave., New York 17, or to that committee in care of the ASME, 29 W. 39th St., New York 18. In either case the request will be routed to the proper committee or individual for preparation of a reply.

Requests for interpretations or changes in the code for clarification can usually be acted upon promptly. Requests for basic changes in the code or questions that disclose the need for basic changes require more time. When an approved reply to an inquiry involves a change in the code rules, the ruling is made public through the issuance of a case. This is published in "Mechanical Engineering" and also issued to all subscribers to the ASME Piping Code Interpretation Service. Other changes are usually handled by issuing revisions to the code once each year. Suggestions for revisions may originate within the committee itself or from anyone outside the committee. The ASME maintains a revision and interpretation service pertaining to the Code for Pressure Piping. The current annual fee is $2 and it is recommended that users of the code subscribe to this service as the most effective means of keeping up to date.

It is expected that the new code will be published in December and it can be obtained by placing orders with the ASME. The price per copy has not yet been established.

A discussi

1. Qualification of materials and equipment. All materials and equipment entering into gas transmission and distribution facilities must be qualified as to their safety for the conditions under which they are to be used. In the case of major items, such as pipe and fittings, this can be accomplished by using items that conform to approved specifications listed in the code. Items for which no standard specifications are listed in the code may be qualified by procedures set forth in the code which are simple or complicated depending upon the importance of the item from the standpoint of safety and the type of service it is to be in.

2. Welding. The code contains a chapter on welding, which covers preparations for welding, qualification of welding procedures and welders, and the inspection and testing of welds. Both distribution system and transmission pipeline welding are covered. The importance of proper welding procedures and adequate quality control when welding high strength pipe for high pressure service is emphasized. The importance of preheating and/or stress relieving under specified conditions is emphasized. In general, the welding requirements correspond closely to those in the new Section 6 of the Pressure Piping Code, which in turn are carefully coordinated with Section 9 of the ASME Boiler and Pressure Vessel Code. API Standard 1104, "A Standard for Field Welding of Pipelines," is acceptable under the code as a field welding specification, if the options in that specification are properly specified in accordance with the code.

3. Fabrication details. A chapter devoted to this subject covers flanges, bolting, gaskets, fittings, valves, branch connections, and special components fabricated by welding. A greatly amplified and improved section on branch connections is given. There are also new sections on expansion and flexibility, and on supports and anchors. The importance of providing adequately for the relative movement of underground pipelines in the design of interconnections between such lines is emphasized.

4. Pipeline design. Pipeline design procedures prescribed in the new code are similar to the design requirements of the code that is now in effect in that design is based upon the specified minimum yield strength of the pipe rather than upon the ultimate strength, and upon nominal wall thickness rather than minimum pipe wall thickness. The maximum stress level permitted for pipelines in rural and thinly populated areas is the same in the new code as in the old, namely 72% of the specified minimum yield strength of the pipe. At this point, however, the similarity ceases. In the new code, design is based on four location classes. Classification of locations is based on the density of population along the route of the pro-

f some important provisions in the code

posed pipeline. A specific method for determining this density is prescribed by the code. These four location classes encompass the entire range from remote, sparsely settled locations on one hand to big city streets on the other. A maximum design stress is prescribed for each location class, the highest being 72% of the specified minimum yield strength and the lowest being 40% of the specified minimum yield strength.

The maximum working pressure of a pipeline is also limited to a specified percentage of the pipe mill test pressure, and this sometimes becomes the controlling factor. The code prescribes that fabricated assemblies, such as mainline valve assemblies, shall be designed for a lower hoop stress than 72% in all cases.

While the provisions of the new code relating design to location of the pipeline differ widely from the existing code, designs based on the new code come closer to conforming to the designs actually used by pipeline companies in recent years than would a design based upon a literal interpretation of the existing code.

5. Installation. The code stresses the importance of adequate inspection during construction. It emphasizes the importance of avoiding scratches and gouges in highly stressed pipelines and prescribes that when such defects are found, they shall be removed. The field repair of such defects is not permitted.

6. Requirements for testing after construction. In general the code requires that all transmission and distribution piping be tested after installation and before being placed in service. If the operating pressure is to exceed 100 psi, both a leak test and a test to demonstrate structural adequacy are required. If the operating pressure is to be below 100 psi, only a leak test is required.

In rural and sparsely populated areas the test to demonstrate structural adequacy may be with gas or air to 110% of the maximum working pressure, or with water to at least 110% of the maximum working pressure.

In fringe areas around towns and cities no gas testing is permitted. In such locations an air test to 125% of the maximum working pressure or a water test to at least 125% of the maximum working pressure is prescribed.

In towns and cities hydrostatic testing is prescribed in all cases where a hoop stress exceeding 30% of the specified minimum yield strength is required during the test. In such locations the minimum test pressure is 1.4 times the maximum operating pressure. Since distribution piping is usually stressed to much less than 30% of the specified minimum yield strength, hydrostatic testing of distribution mains and services is rarely required under the code.

The code prescribes that in all cases the testing be done with due regard for the safety of employees and the public during the test. It requires that in all cases where air or gas is used as the test medium "steps shall be taken to keep persons not working on the testing operations out of the testing area during the period in which the hoop stress is first raised from 50% of the specified minimum yield strength to the maximum test stress, and thereafter until the pressure is reduced to the maximum working pressure."

7. Cast iron pipe. Design requirements for cast iron mains and services conform generally to the requirements of ASA A21.1, A21.3, A21.7, and A21.9.

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included in this latest expansion program of this fine company.

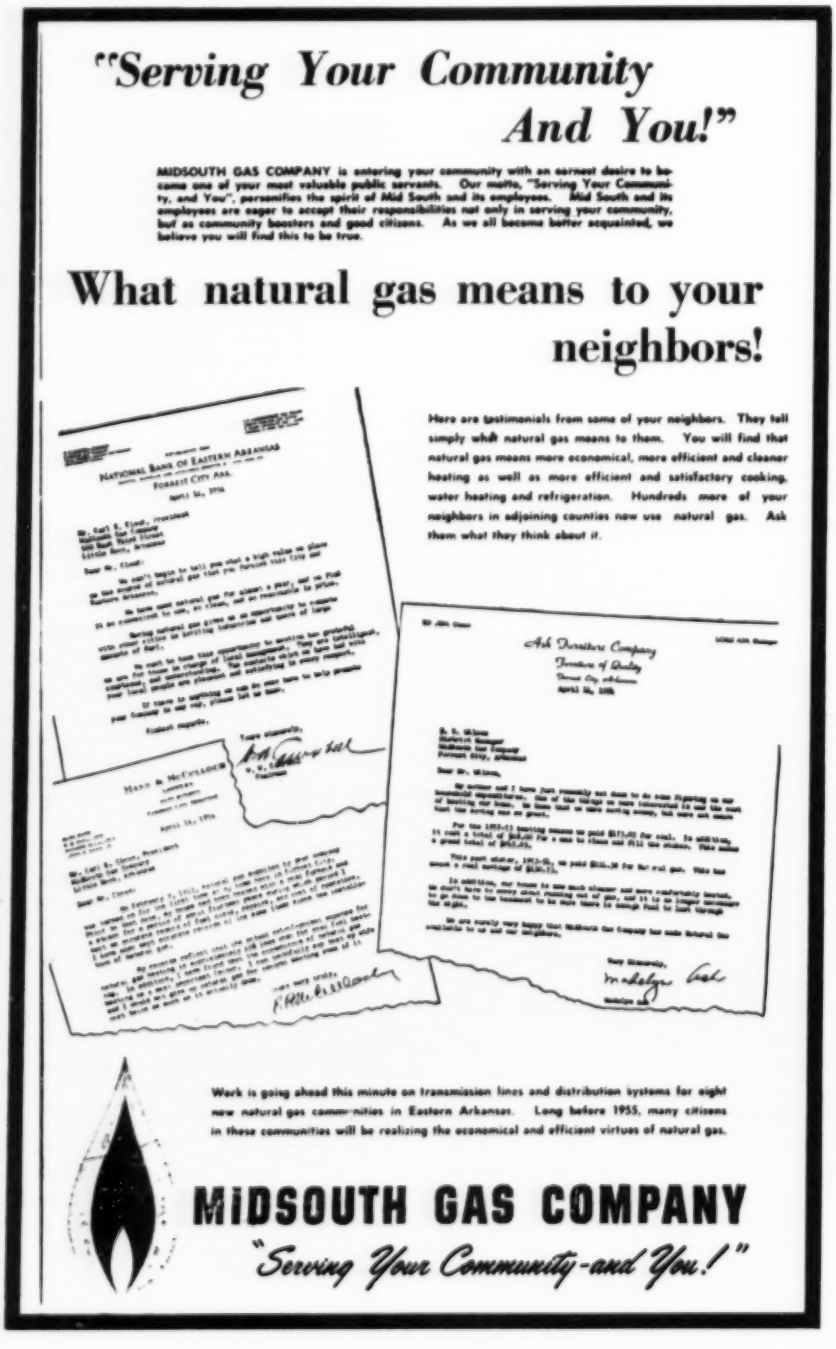
It has been the pleasure of your editor to meet many of these men of MidSouth Gas personally in keeping you posted on the developments in Parkin. And we can truthfully say that we have never had the privilege of knowing finer anywhere. They are devoting every ounce of their energy to the rapid construction of the distribution lines that are to serve us. They are leaving no stone unturned in giving the most efficient service possible at the least inconvenience to the city and property owners herein.

We would like to add a word about the fine crew of workers employed by the gas company through the contractor. We do not have their pictures nor do

GAS exclusive

MidSouth expands with unique service agreement

Eight Arkansas communities finance construction of facilities to bring natural gas to them; MidSouth will build lines and operate system.


"Serving Your Community And You!"
MIDSOUTH GAS COMPANY is entering your community with an earnest desire to become one of your most valuable public servants. Our motto, "Serving Your Community, and You", personifies the spirit of Mid South and its employees. Mid South and its employees are eager to accept their responsibilities not only in serving your community, but as community boosters and good citizens. As we all become better acquainted, we believe you will find this to be true.
What natural gas means to your neighbors!
Here are testimonials from some of your neighbors. They tell simply what natural gas means to them. You will find that natural gas means more economical, more efficient and cleaner heating as well as more efficient and satisfactory cooking, water heating and refrigeration. Hundreds more of your neighbors in adjoining counties now use natural gas. Ask them what they think about it.
Work is going ahead this minute on transmission lines and distribution systems for eight new natural gas communities in Eastern Arkansas. Long before 1955, many citizens in these communities will be realizing the economical and efficient virtues of natural gas.
MIDSOUTH GAS COMPANY
"Serving Your Community-and You!"

FOR the third successive summer since Carl E. Cloud became president of MidSouth Gas Co., one of Arkansas' fastest growing corporations, the company team has embarked on a project that will mean much to the four-year-old utility.

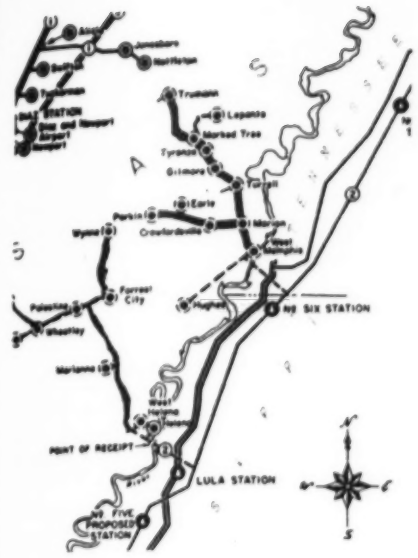
In the summer and fall of 1952 the company expanded its facilities in three old districts and created a new one to bring natural gas to thousands of eastern Arkansas residents.

Last summer MidSouth built two 7300-ft pipelines under the Mississippi river to supply gas to a newly created West Memphis district and for its proposed expansion in 1954, work which is well under way now.

The 1954 expansion program, which will bring natural gas to eight more eastern Arkansas communities in three counties, is novel and unique in the respect that the communities will issue revenue bonds to pay for construction of the transmission and distribution systems. MidSouth will build the system and upon completion, will sign a 20-year agreement with the town officers to operate the new properties, guaranteeing enough annual income to retire the bonds.

This expansion approach has never been attempted before on a multiple basis, but has caught the fancy and interest of citizens in the eight commu-

MidSouth's campaign to introduce itself to its new customers is typified by the ad at left. Above is the reaction of the local press.



Area to be benefitted by novel agreement.

nities who have been looking forward to using natural gas for many years.

The mechanics which led up to the actual construction of the system were tedious and loaded with red tape. But in following through on the intricate details of the program, President Cloud probably became his company's chief public relations officer as well as its chief executive. He addressed civic and cultural organizations in all eight communities, met almost continually with city council members, contacted landowners and got well acquainted with a favorable press.

Simplified, the program worked this way. The city councils passed ordinances calling for municipal elections which would give all voters opportunity to approve or turn down the proposal. The elections then were held in the eight towns. Overwhelming approval was given the proposal as only 39 negatives votes were cast in the eight towns, as compared with 1814 for the project. Then the city councils passed ordinances calling for issuance of revenue bonds to cover cost of their respective distribution systems and a pro rata share of the transmission lines leading from Marion, Ark. Following passage of the ordinance, petitions then were circulated to get permission of owners of more than 50% of the assessed property in the town to go ahead with construction.

Before contacting citizens and city councils, MidSouth had arranged with the Northwestern Mutual Life Insurance Co. of Milwaukee to buy the revenue bonds at 4% interest, should the towns approve of the project.

Much consideration was given to the preliminary buildup on the projects. President Cloud, General Sales Manager R. P. Hill and Vice President William A. Green contacted citizens to explain the plan. Then Mr. Hill called on newspaper editors in the expansion area to explain the program and deliver news releases on developments. Press reception was excellent and several favorable editorials were reproduced throughout the system.

Inauguration of this type of program is in line with MidSouth's pay-as-you-go expansion. Company leaders felt that it would be unwise to issue additional common stock in fairness to the stockholders, most of whom reside in Arkansas. Over the 20-year period, if the company accumulates enough reserve, it can assume full obligations for the bonds and buy the systems from the towns.

Speaking tour

To acquaint the taxpayers with this novel proposal, President Cloud spoke before dozens of clubs; question-and-answer columns were run in all newspapers and news stories carried about progress of the plan.

The company had to get across to citizens of each community that issuance of the revenue bonds would in no way place a lien on their's or the city's property; that MidSouth guarantees sufficient annual revenue to retire the bonds and that the company would operate the properties efficiently.

President Cloud (left) told the story of the plan throughout the new service area. A. O. Shaw (right) heads the newly created service area.

Creation of the new area, which will be under jurisdiction of the new West Memphis district, headed by A. O. Shaw, also gave the company opportunity to make some well deserved promotions. Veteran service personnel from throughout the system were transferred to more responsible jobs in the expansion area.

Completion of the project this fall will mark the end of an important phase in the expansion of the company. The operating properties will have been increased by 21 towns and communities in two years and will expand MidSouth's highly successful merchandising program.

Point at which the Mississippi river was spanned by two 7300-ft lines to supply gas to the new West Memphis district.

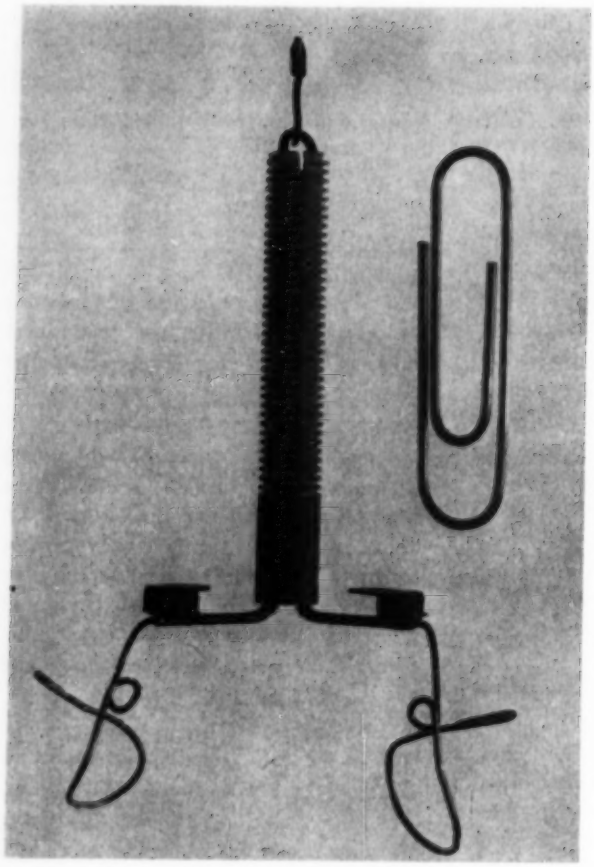


Fig. 1. Ceramic core wound with the platinum heater wire and with the U-shaped "warm" electrode inserted in one end. Note comparison in size with the paper clip.

A new electrical device to locate leaks of inflammable gases

By W. C. WHITE
General Electric Co., Schenectady, N. Y.

A NUMBER of devices to detect the presence of inflammable gases in the atmosphere are available.[1] These are useful in indicating the concentration of inflammable and explosive gases in closed spaces. They give a quite accurate quantitative response to the presence of such gases long before they have reached the danger point as an explosive mixture.

Not too suitable

These devices, however, are not very suitable for finding the exact location of leaks in pipes, fittings, or tanks; and, of course, such leaks are usually the cause that leads to dangerous concentration of inflammable gases in the air.

With the greatly increased use of natural gas and bottled fuel gases, there is a need for a device for finding the exact location of small leaks. Such a device is now undergoing development. It is similar, as to results, to a halogen vapor detector presently in use.

Selectively sensitive

A few years ago, a thermionic phenomenon was applied to the technique of leak detection.[2-4] This type of leak detector is one that is selectively sensitive to the halogens or their compounds. It is being used almost universally today in the factory testing of household refrigerators, freezers, water coolers, and air conditioning units. Freon is the refrigerant in practically all of these appliances, and this compound is rich in the halogen gases fluorine and chlorine. The halogen leak detector measures the flow of positive ions from a red-hot platinum wire to a negative electrode in a stream of air to be tested. When even the slightest trace of halogen or a halogen compound vapor is in the air stream, the positive-ion emission current is greatly increased. This increase of current is made evident to the operator of the detector in a variety of ways. The detector is particularly adaptable to finding the location of small leaks owing to the fact that the air passing through the detecting element is drawn in through a small tube which can be used as a probe to test the air at any point of suspected leakage or over small areas.

The new gas-sensitive unit

The gas-sensitive element operates as a result of an entirely different phenomenon than that taken advantage of

This article has been adapted from a talk presented at the meeting of the American Institute of Electrical Engineers in Los Angeles in June.

in the halogen vapor detector.

Ceramic materials become electrically conducting to a varying extent as their temperature is raised. For alumina of a high degree of purity, the temperature must be very high, almost a white heat, before this conduction becomes very appreciable. However, when the alumina contains a salt, particularly that of an alkali metal, this electrical conductivity, which is electrolytic in its nature, occurs at a much lower temperature. If, during manufacture, the alumina is fired only to a low temperature, say 1350° C, it will absorb a chemical compound readily from a water solution. A piece of ceramic so treated becomes an ionic solid conductor above 300° C.

Variation occurs

In a material of this sort, a variation in electrical conductivity occurs along its surface when it is operated in the proper manner and when in the presence of a small amount of inflammable gas in the surrounding air. One of the electrodes in such an arrangement is simply a connection with the body of the ceramic. The other electrode is special in that it is operated at a temperature somewhat above that of the ceramic body. This is accomplished by passing current through a small platinum wire which is tightly wound in a threaded groove on the surface of the ceramic core. Where this hot platinum wire touches the surface of the ceramic, the resistivity of this junction appears to be highly sensitive to small amounts of gas in the surrounding air.

For convenience in design and operation, this hot wire is also used as a source of heat for the ceramic core to maintain it at the correct temperature. A ceramic core wound with the platinum heater wire and with the U-shaped "warm" electrode inserted in one end is shown in *Fig. 1*.

The phenomenon involved can best be described by reference to *Fig. 2*. Here, for simplicity, there is shown in cross section a single element of platinum heater wire in a groove in the threaded core. A connection is made to the body of the ceramic and this is called the "warm" electrode, in that it is simply a connection. The "hot" electrode is the piece of platinum wire operated below red heat by passing a current through it. The response to inflammable gases seems to take place where the hot platinum wire contacts the ceramic. Here, apparently, a form of barrier junction builds up. Practically the whole interelectrode voltage appears at this barrier junction, but it shows a tendency to "break down" when the surrounding air contains a trace of inflammable gas.

Structural design of the element

There is a very practical reason for building this hydrogen- and gas-sensitive element in the way described, even though undoubtedly other structural designs could be devised to take advantage of this particular phenomenon.

A sensitive element of this sort is a relatively small and inexpensive part of the whole equipment necessary to make a useful leak detector; the circuit components, housing, indicating devices and other accessories are much larger and more expensive than the element itself. Therefore, an inflammable gas-sensitive element that can be used in existing halogen-detecting equipment is very advantageous. In other words, this new element is made to be as electrically and mechanically interchangeable with the halogen-sensitive element as possible.*

There are only three minor differences between this and the halogen-sensitive element: (1) The alumina core is made an ionic conduction solid. (2) A higher-resistance platinum wire is used so that the core operates at a lower temperature. (3) An electrical connection has been added between the outside cylindrical electrode and the "warm" electrode connection to the ceramic piece. In this new element, the outer cylinder is no longer an electrode but is simply used to guide the air flow over the surface of the ceramic core. This cylinder is thus used also as part of the electrical connection to the "warm" electrode.

Electrical characteristics

As a dc circuit component, this element has some of the ionic conduction characteristics of an electrolyte. It polarizes and builds up the equivalent of a counter-electromotive force, but this built-up barrier breaks down intermittently as the voltage is raised above a certain value, which is between 300 and 325 volts for the element described. Apparently, this breakdown voltage is lowered when the air around the sensitive area of the ceramic core surface contains a combustible gas.

It is necessary, therefore, to maintain the interelectrode operating voltage in a certain range. Again for the device described, the response to a gas-air mixture falls off rapidly as the interelectrode voltage goes below 275 volts. It is erratic and unsatisfactory in operation, owing to abnormally high currents, as this voltage approaches 325 volts. Operation appears most satisfactory when the hot platinum wire operates as the positive electrode. The leak detector equipment for which this element is designed is operable only from

*It should not be used, however, in presently constructed General Electric halogen-detecting equipment because such equipment is not explosion-proof; a redesign is under consideration.

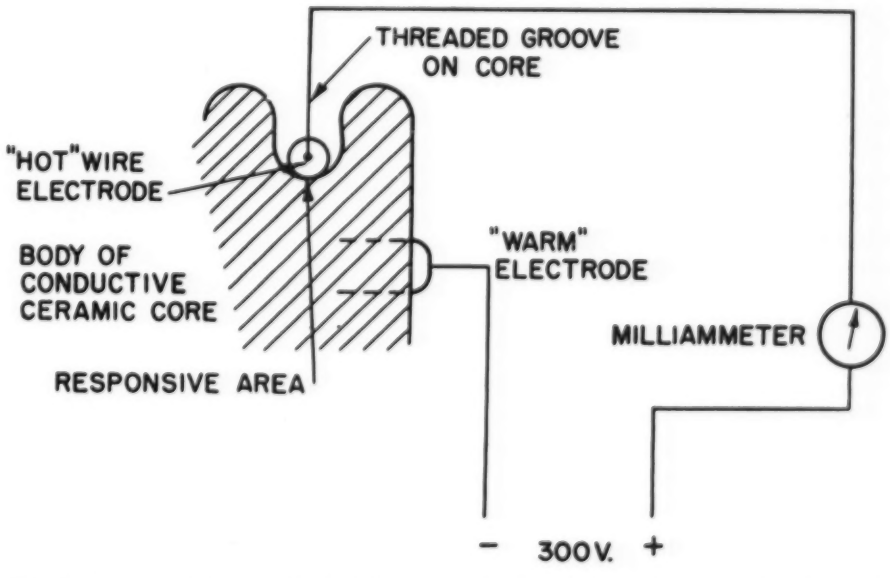


Fig. 2. Cross section in a single element of platinum heater wire in a groove in the threaded core, describing the phenomenon involved.

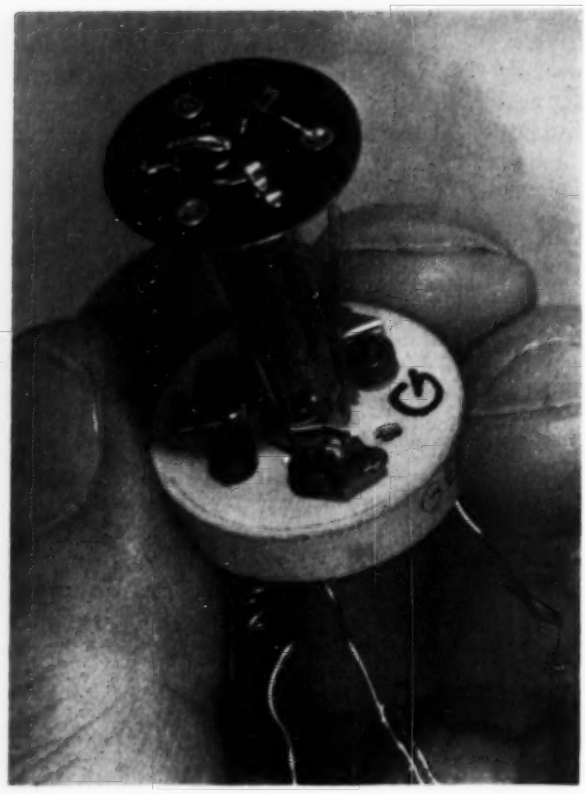


Fig. 3. The assembled detector element.

a 115-volt ac supply, and requires about 100 watts.

Observations of the interelectrode current with an oscilloscope show that, when the element is exposed to air containing a combustible gas, there is an irregular increase of current similar in nature to that which occurs when the voltage across an electrolytic capacitor approaches the breakdown point. When the dc interelectrode voltage contains a slight ripple, the increase of current with exposure to gas occurs at the peak of these ripples. Therefore, it is essential for best operation to use a well-smoothed-out dc voltage supply.

Similar also to the characteristics of an electrolytic capacitor is the element's response to changes in dc operating voltage. For instance, if the interelectrode voltage is lowered, say from 300 to 285 volts, the immediate response as a gas detector is greatly lowered. However, the polarization effect adjusts itself after a few moments to this lowered voltage and the element quickly regains almost normal response.

In a similar way, a sudden increase of 10 or 15 volts may cause an intermittent breakdown or a false indication, but soon the element adjusts itself to this new voltage and the operation again becomes normal.

The element as now built, therefore, cannot be considered as an instrument giving an absolute indication of the amount of inflammable gas in the air, but rather as a device to detect the presence and location of a leak.

Operation

The satisfactory operation of this device is not all critical to the temperature of the ceramic core and its heater wire. It shows little change with a ± 10% change in normal heater voltage. The rated heater voltage is usually somewhere between 10 and 17 volts.

This element is not sensitive to halogen vapors and should not be used with them, as a heavy dose of such vapors will poison the element and require that it be operated in the air for several hours to return it to normal condition.

This new element is sensitive to hydrogen, natural gas, alcohol vapor, and a number of other inflammable or reducing gases in the air passing through it. As the element operates below a red heat, there should be no danger from igniting inflammable gas-air mixtures under normal operating conditions. The new element is also sensitive to water vapor. This does not introduce any complications when the equipment is used in a high-humidity atmosphere because the response to natural gas and hydrogen is additional to that of water vapor.

The impregnated ceramic core of these gas-sensitive elements adsorbs some moisture from the air when not in use. Therefore, when first operated, it may show excessive interelectrode current. In a few moments, this returns to normal but again rises as the body of the ceramic core warms up. If it has been standing in moist air for some time, it may then take as long as 15 minutes at rated heater current to dry out the core so that operation is normal.

In searching for small leaks, it is best to remove any dust or small particles from the surfaces being checked, as they sometimes give a false indication.

Sensitivity

As has been stated, this device as now built cannot be considered as giving an accurate quantitative response. Therefore, it is only possible to give an approximate figure for its sensitivity. The response to hydrogen is such that it is possible to detect a few parts per 10,000 by volume. Expressed in another way, the element is capable of detecting a leakage rate of about 1 cu in. per hour at atmospheric pressure.

For combustible gases that are chemical compounds, the sensitivity is somewhat greater and appears to be better the heavier the molecular structure of the gas.

In any leak detector, particularly when first used, it is always convenient to have some easy method of checking its sensitivity to be sure it is operating normally. In this device, a very simple test is to cup the hand around the air intake. Normally there is enough moisture evaporating from the hand to give an indication. In very hot, humid weather, this is not satisfactory, but under such a condition the breath can be used in the great majority of cases.

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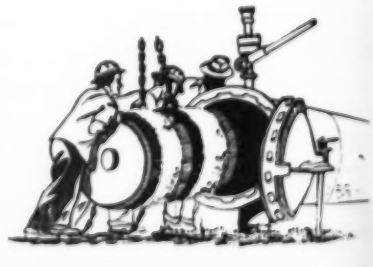


Penn State offers wide variety of fuel studies

Resident instruction, research and extension courses are offered in both natural gas and fuel technology.

Graduate students in fuel technology aid in research projects such as this theoretical study of the gasification rate of carbons conducted here by a graduate student.

NEARLY 100 years ago, on Feb. 22, 1855, the Pennsylvania General Assembly passed an act chartering a Farmers high school to educate youth "in the various branches of science, learning, and practical agriculture." This Farmers high school, of which the first graduating class in 1861 numbered 11 men from seven Pennsylvania counties, was the forerunner of the Pennsylvania State University, the state's land-grant institution, which this past June awarded degrees to nearly 1600 men and women from 34 states, the District of Columbia, and seven territorial possessions and foreign countries.

More than 400 degrees

Since the early 1930's, when the curriculas in fuel technology and petroleum and natural gas engineering were established at Penn State, well over 400 baccalaureate, advanced, and technical degrees have been granted in these two departments, in which Penn State's instruction in the production and utilization of natural and manufactured gas is centered. The work is a part of the program of the College of Mineral Industries, of which Dr. Elburt F. Osborn is dean.

Although the first undergraduate courses relating to petroleum and natural gas engineering at Penn State were offered in 1907, it was not until 1932 that this curriculum was established with Professor C. A. Bonine in charge.

The fuel technology curriculum at the university had its beginnings in mining engineering as far back as 1893, and in 1932 a separate curriculum was established with Dr. A. W. Gauger in charge. Until recently, Penn State was the only university in the country offering a four-year course on fuels.

As in other technical colleges of the university, the activities in mineral industries fall into three closely related categories: resident instruction, research, and extension and correspondence instruction. It is necessary to discuss the functions of each in order to understand fully the contributions of the two departments to the science of gas engineering in the state and in the nation.

Entrance requirements

To be admitted as a student in either department, an applicant must have been graduated from an accredited secondary school and must have completed at least 15 units of specified preparatory work. Regardless of the curriculum in which they are enrolled, all freshmen in the College of Mineral Industries are required to take a common program of studies.

In the sophomore year, required courses are more specialized than in the freshman year. Second-year students in petroleum and natural gas engineering take differential and integral calculus, general physics, introductory mineralogy, quantitative analysis, petrology, introductory petroleum engineering, and a three-week summer practicum in geologic surveying. The practicum ordinarily is scheduled between the sophomore and junior years, and is conducted at the Mineral Industries Camp in Stone Valley, several miles from the campus.

Second-year studies

Sophomores enrolled in fuel technology take courses in chemistry, mathematics, and physics required of those in petroleum and natural gas engineering, in addition to courses in elements of mineral preparation, statics, introductory fuel technology, and fuel testing and calorimetry.

The degree of specialization increases greatly in the junior and senior years, with comparatively few courses being common. However, both fuel technology and petroleum and natural gas majors are required to study technical

GAS exclusive

Courses deal fundamentally with the production of oil and gas

writing, introductory physical chemistry, and chemical engineering, with the statics course being taken by the latter group in the junior year. Other junior courses in petroleum and natural gas pertain to the geology of oil and gas, engineering thermodynamics, mine surveying, reservoir rocks and rock-fluid systems, and reservoir fluids. Laboratory courses in reservoir fluids and rock properties also are required. Additional junior requirements in fuel technology are organic chemistry, experimental physical chemistry, thermal processing of fuels, combustion engineering, strength of materials, and mechanical properties of engineering materials.

Senior course of study

Senior courses for majors in fuel technology include combustion engineering laboratory, fuel gases and gasification, energetics of fuel technology, coal preparation, chemical processing of fuels, fuel technology research and design, and a field trip of a week's duration to inspect plants engaged in production, processing, and utilization of fuels. During their final year, petroleum and natural gas majors study principles of reservoir behavior, seismic prospecting, exploitation and development engineering, electrical engineering, drilling and production technology, and petroleum production processing, with laboratory work being taken concurrently with the last three courses. In addition, seniors attend a seminar in current problems and literature relating to technological and economic aspects of the petroleum industry, and either write a thesis or take an approved elective. In the junior and senior years of both curriculas, flexibility to meet the needs of individual students is attained through the choice, with advice from the faculty, of technical and nontechnical electives.

With a few exceptions, courses given by the department of petroleum and natural gas deal fundamentally with the production of both oil and natural gas, since the problems of each are the same. At Penn State petroleum engineering is conceived as that which concerns the recovery of minerals from the earth by fluid processes. The petroleum and natural gas engineer may be called upon for engineering work pertaining to the production of natural gas, the production of crude oil, the storage of natural gas underground, or the injection of water into underground strata. He also must understand the nature of the rocks within the earth which contain and through which are transmitted these important natural fluids. Thus, he must study the forces that drive oil and natural gas from the rocks and the forces by which oil and natural gas are retained in the earth, as well as the operations by which these fluids are recovered.

Since the department feels its graduates should be familiar with all phases of petroleum engineering, seniors participate in field trips, occupying a day or a day and a half, to locations of oil-producing, refining, and equipment-manufacturing plants, gas-producing or storage areas, and natural gasoline and gas transmission plants. Most of these trips are to the western part of the state.

The 276 graduates of the petroleum and natural gas engineering curriculum have found employment not only with oil and gas companies but also with drilling concerns, pipeline operators, engineering consulting firms; with service companies specializing in core analysis, well-logging, and well-completion techniques; and with sales organizations that supply the industry with its tools and equipment. In addition, there are government jobs with the U. S. Bureau of Mines and with the several agencies that supervise practices of the industry for conservation purposes.

In recent years a majority of the 112 graduates in fuel technology have entered the field of combustion engineering with large producers or users of fuel, or with equipment manufacturers. About 12 have entered the gas industry, while others have been employed by the petroleum, coking, and chemical-processing industries, or have taken advanced work at the graduate level to prepare for positions in institutional or governmental research laboratories.

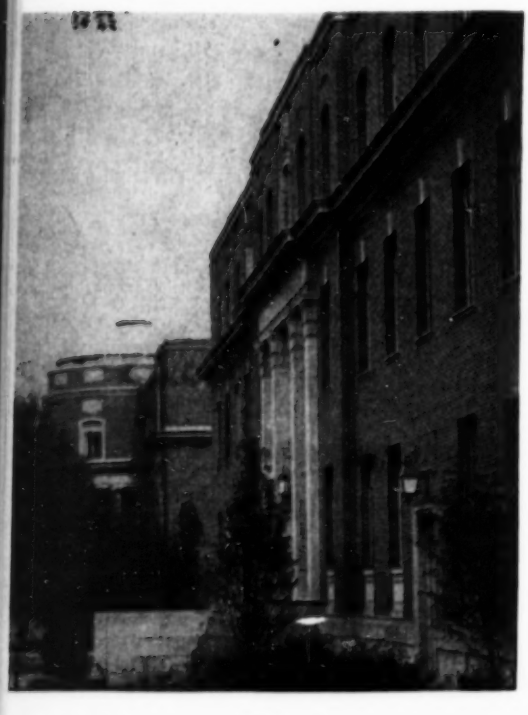
In placing graduates, both departments work through the University Placement Service, which serves as a clearing house for contacts and interviews leading to employment. Other requests from companies come directly to the departments, which arrange meetings between company representatives and students.

Graduate level

Although seniors are given the opportunity to aid in minor phases of regular research projects, the great part of research work in both departments is conducted on the graduate level. In addition to their research activities, however, graduate students in petroleum and natural gas take advanced courses in gas and petroleum production. The specialist in gas engineering may elect during his junior or senior year three courses which also are open to graduates: natural gas and gasoline plants, natural gas laboratory, and advanced core testing.

The first of these concerns the production, analysis, measurement, and transmission of natural gas. The second, taken concurrently with the first, deals with various types of flow meters, the physical properties of natural gas, adsorption agents, analysis by Orsat, and low-temperature fractionation. In the third course emphasis is placed on testing physical and chemical properties of oil-bearing formations and on coring methods, sample preparation, porosity, permeability, grain size distri-

Facilities of Penn State's departments of petroleum and natural gas and fuel technology are housed in two buildings, Mineral Industries and Mineral Sciences.



bution, saturation, and laboratory recovery tests. Courses on the strictly graduate level which would be of interest to gas engineers cover energetics of petroleum engineering, the flow of homogeneous fluids through porous media, advanced petroleum engineering design, condensate fields, and colloidal behavior of industrial clays, muds, and slimes.

Gas specialists among graduate students in fuel technology find at least three courses more or less tailored to their needs: advanced combustion, advanced thermal processing, and synthesis of liquid fuels. The first includes instruction in advanced combustion and heat balance calculations, ignition and flame characteristics of fuels, selection of fuels with reference to use and equipment, and furnace atmospheres. The second is concerned with pyrolysis, coal carbonization, coke manufacture and uses, action of heat on coals and fuels, and technical and economic factors of thermal processing. The third expands the students' knowledge of the chemical nature of liquid hydrocarbons, preparation of hydrogen and synthesis gas, and theoretical and practical aspects of synthetic liquid fuel processes.

The prospects of graduate study in gas engineering are enhanced by several fellowships that have been made available to superior students. These grants carry substantial stipends that enable students to go on for advanced degrees while engaged in specified research projects. Through the department of petroleum and natural gas, a fellowship is offered annually by the Pennsylvania Natural Gas Men's Association, and occasionally by the Natural Gas Supplymen's Fund of the American Gas Association.

In addition to the B.S., M.S., and Ph.D. degrees, both departments may award technical degrees—fuels engineer in fuel technology and petroleum engineer in petroleum and natural gas engineering—to qualified candidates.

Research, both fundamental and applied, has always been a vital function of the two departments, even before they were established as such.

Research finds expression through the Mineral Industries Experiment Station, which is not set up as a separate department but whose staff is composed of all members of the college faculty engaged in research, with Dr. John A. Hipple as director.

Research activities of the department of fuel technology include projects on anthracite and bituminous coal and tars, ranging from purely theoretical studies to plant-scale application of research developments.

Three major research projects pertaining to gas are currently in progress. One is the study of gas reactions of carbon with steam, carbon dioxide, and oxygen to explain and predict why carbons have reacted and will react at certain rates with these gases. In the course of study such carbon properties as unit-cell dimensions, crystallite size, surface areas, pore distribution size, and true and apparent densities have been examined. In addition, the catalytic conversion of carbon monoxide to carbon and carbon dioxide is being studied. The second project is a study of flame stability and flame velocity of hydrocarbon-carbon monoxide mixtures, results to date having shown that hydrocarbons markedly change the combustion properties of carbon monoxide. The third project involves theoretical studies to predict the flame velocities of hydrocarbon-air mixtures by use of basic combustion equations.

Production and utilization

The experiment station, through the department of petroleum and natural gas, has carried out investigations in both the production and utilization of natural gas, in part in cooperation with the industry. One of these investigations has led to the development of a new type of household incinerator, which overcomes many of the disadvantages of the older types. The department recently finished a project concerning natural gas pipeline deposits, and began one on the effect of odorants, lube oils, and condensate water on gas storage reservoirs. Both projects come under the sponsorship of the Pennsylvania Natural Gas Men's Association.

Since the College of Mineral Industries was one of the pioneers in the development of methods for the analysis of core samples of oil-producing formations, the petroleum and natural gas engineering laboratories are well equipped for the determination of porosity, permeability, fluid saturations, relative permeability, capillary pressure, electrical resistivity, and other tests on oil reservoir rocks and their contained fluids. Equipment is also available for the testing of oil field fluids under reservoir conditions and for pressure-volume-temperature studies on these fluids. These include testing for condensate behavior and formation of gas hydrates. There is complete equipment for the study of drilling muds and for examining oil field emulsions and the behavior of oil field cements.

Experimental facilities

Special facilities are available for experiments on the physical properties and composition of natural gases. Metering equipment for measuring natural gas flow and equipment for low-temperature fractional distillation are standard laboratory items. Equipment is also available for determining the susceptibility of reservoir rock strata to gas storage.

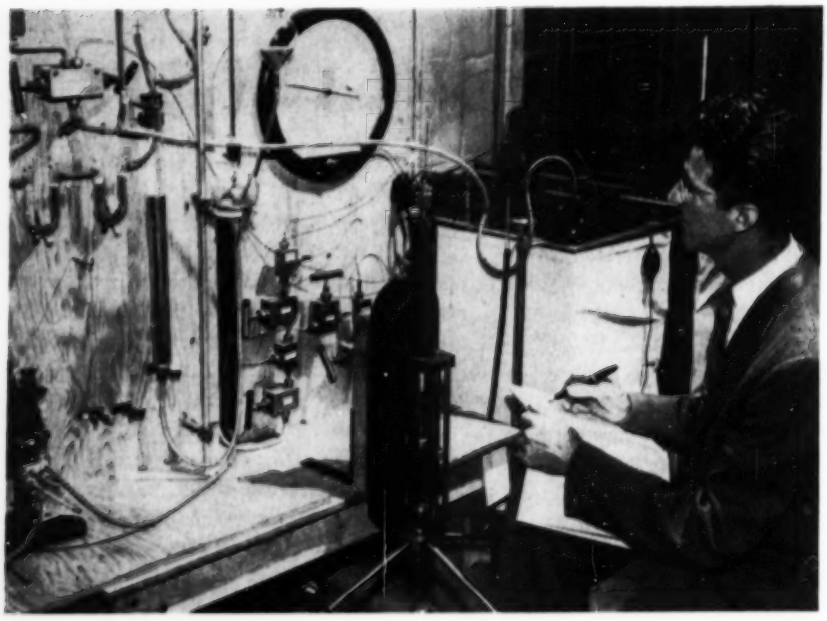
The department of fuel technology has instructional and research facilities for work in all phases of the testing, processing, and utilization of fuels. Laboratories for advanced study and research include a high-pressure laboratory for extraction and hydrogenation studies on coal and tar; laboratories for fundamental and applied research on the origin, constitution, and chemical processing of coal and for the separation, purification, and identification of products resulting directly or indirectly from the physical or chemical processing of the mineral fuels; a carbonization laboratory; an ash fusion laboratory; combustion laboratories for fundamental and applied studies on the mechanism of combustion, reactivity, and reaction kinetics of the mineral fuels. Also available are float and sink equipment, coal-crushing, sizing, and preparation equipment, petrographic microscopes, infrared, ultraviolet mass spectrometers, an electron microscope, X-ray equipment, and other facilities required for studies on mineral fuels and their products.

Just as the program of resident instruction is diversified and upgraded by the integration of research results into classroom work, so does it benefit from the solution of day-to-day industrial problems brought to light through the Mineral Industries Extension Services, directed by Professor Donald C. Jones.

Petroleum and natural gas extension courses, originally developed on a three-year basis for all of the industry, later were divided to provide three-year programs for the natural gas, petroleum production, and petroleum refining sections. The natural gas program comprises three courses with a separate text

500 persons have enrolled in fuel technology extension courses since 1948

for each, taught by classroom instruction throughout Pennsylvania and by correspondence anywhere in the United States. Classes organized within the state are financed by federal and state funds, and the only cost to the student is his textbook and a small deposit fee which is refunded if he attends 75% or more of the scheduled class hours. A grade report is granted for successful completion of a course by classroom instruction, and a certificate is awarded to those who complete the entire program. A recognition card is given to correspondence students if they complete a course satisfactorily, and a certificate is awarded to those who request it when the entire program is completed successfully.



Current research in petroleum and natural gas engineering includes this pressure-volume-time experiment on the equilibrium composition of the gas phase of a three-component system. Work is conducted here by Alan H. Meldrum, a research associate.

The first course in this program covers development of the petroleum industry, mathematics, physics, and inorganic chemistry, and is open to anyone regardless of the extent of his education; the second course deals with exploration, drilling, and development of natural gas and petroleum reservoirs; and the third, with natural gas economics, properties of natural gas, well-completion and operation, compression, transmission, measurement and regulation, natural gasoline manufacture and cycling, and stabilizers and stabilization. All three texts were written by M. M. Stephens and Oscar F. Spencer, the latter being in charge of petroleum and natural gas extension. The text for the last course, "Natural Gas Engineering," is used by most petroleum engineering schools in the country and, together with that for the second course, "Petroleum and Natural Gas Production," by the International Correspondence Schools.

From 1931 to the end of the fall semester of 1953, enrollment in petroleum and natural gas extension programs totaled 10,373, of which about 2000 were from natural gas firms.

Fuel technology extension work began in 1948, and since then has enrolled more than 500 persons in its various programs. The fuel technology extension program is intended to provide the type of training that operators of fuel-burning equipment, supervisors, and technicians need in order to secure the most efficient utilization of fuels. Three courses are offered which are applicable in the fields of metallurgy, ceramics, and power and heating plants.

The first, basic fuels and combustion, provides an introduction to solid, liquid, and gaseous fuels, including a description of the occurrence, use, analysis, and properties of coal, oil, natural gas, coke, producer gas, water gas, oil gas, and others; fundamental chemistry related to the combustion process; combustion calculations; and material and heat balance. The second course, advanced fuels and combustion, deals with the application of fuels, combustion equipment, practical fuel-burning problems, and combustion control. The third course, utilization of fuels in power plants, to date has been offered in only one location, Philadelphia, but can be made available elsewhere upon request.

Most of the men served by fuel technology extension are steel plant employees, the majority of the courses being centered in the Pittsburgh and Bethlehem areas. Other groups that utilize extension facilities are power plant operators and coal salesmen.

Another valuable function of the College of Mineral Industries is that of playing host to groups holding conferences on the campus, making available its facilities and staff members for the further dissemination of new theories and practices within the field. One of these groups has been composed of persons connected with the general field of liquefied petroleum gas, who were sponsored by the east-central district of the Liquefied Petroleum Gas Association. The group has considered such subjects as safe practices in handling L. P. gas, public relations for the serviceman, motor vehicle safety, selection and proper installation of equipment, servicing of controls and appliances, and calculating heat losses and operating costs.

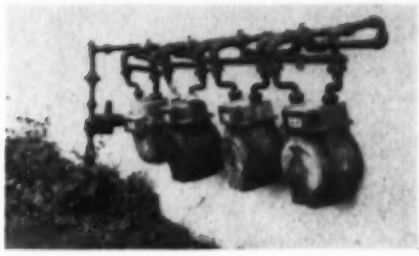
Full details regarding the departments, admission requirements, and courses are included in the General Catalog, a copy of which may be obtained by writing to the Dean of Admissions, The Pennsylvania State University, State College, Pa.

Next month

The role of Texas A&I college in natural gas education will be discussed next month. Previous articles have covered the universities of Houston and Michigan, with sidelights on Purdue and Columbia.

GAS staff report

Meter covers gaining in popularity among domestic gas consumers



Meter installations such as these are the eyesores that meter covers have been designed to eliminate.

By **WILLIAM W. CLARK** • Editorial Director

HANDSOME as some of the newer domestic meters are, a meter set assembly complete with risers and elbows and odd joints of pipe is acknowledged to be an unattractive appendage to a sleek modern home. And even the meter becomes weatherbeaten after a blustery season or two.

Three manufacturers have taken advantage of this situation to enter the market with meter covers. With utilities becoming more customer relations-conscious every year, and with increasing meter reading costs making the economics of outside metering more attractive, acceptance of the covers has already been encouraging.

Manufacturers increasing

Manufacturers are moving into markets from both ends of the country. From the Far West, Zenith Plastics Co. of Gardena, Calif., has made promising progress with its reinforced plastic meter-and-regulator covers, especially in the Long Beach and Los Angeles areas.

The first meter domes were the yard models, which were sunk to a several-inch depth in the ground. Southern California Gas Co., Los Angeles, has installed these models in several thousand residential locations. The Zenaloy product is plastic, produced by molding strands of glass fibers with a polyester resin, and its light weight, weather and corrosion resistance, and ease of handling have given it preference over older, heavier, and less durable types.

Metal covers

In Jackson, Mich., Handley-Brown Heater Co. has brought out a metal cover in two principal models, both wall mounted, one a recessed box and the other a wall-attached unit. Consumers Power Co. of Jackson has installed more than 1000 of these to date.

Buckeye Supply Co. of Zanesville, Ohio, is also on the market with plastic "meter domes," having recently announced a new wall-mounted type as a companion to the other yard meter housing.

In southern California, where outside meter installations are standard because of the mild climate, various efforts have been made in the past to camouflage the MSA. In Long Beach, where the gas system is municipally owned, meter covers are a matter that is regulated by ordinance. In the past, the ordinance required that a lean-to or doghouse structure be erected as an appendage of the house. Built at a cost of about $50, these were bulky, immobile, and tended to deteriorate around the doors, sills, hinges, and jambs. Every new home was required to have one.

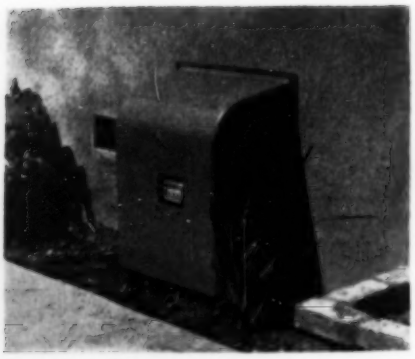
Zenaloy housings have changed all this. The city has now rewritten its ordinance to permit the use of the plastic covers, although the home owner may have his choice. The cost is borne by the customer.

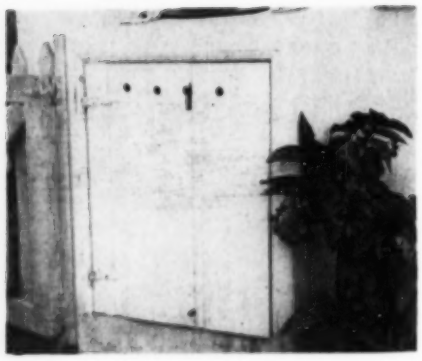
The newer models are wall-mounted, which afford better protection from gophers and other pests.

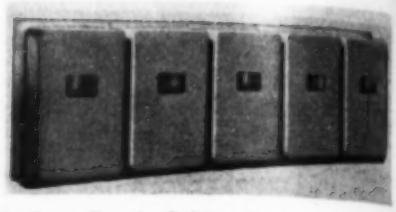
Western market

According to Gordon Z. Greene of Zenith Plastics, Mountain Fuel Supply Co., Salt Lake City, is letting bids for meter box covers, having adopted them as a standard installation item, and other western utilities are investigating their possibilities.

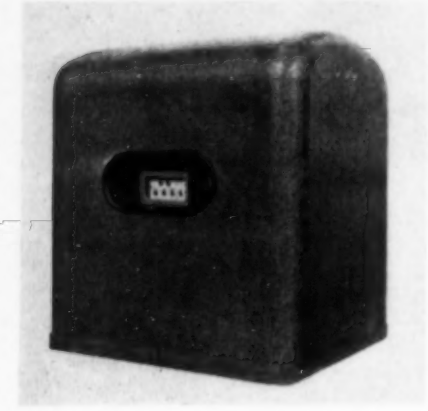
Utilities in colder climates have been reluctant to put their meters outside, according to Herbert S. Blanding, general appliance supervisor for gas at Consumers Power. "But when they found it necessary, they usually had the customer build a wooden 'dog house'



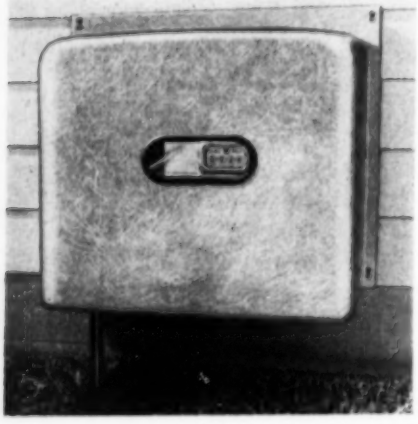




In Long Beach, Calif., where outside meter protection is regulated by city ordinance, unsightly "doghouses," which were relatively costly to construct, are giving way to smart new meter covers. The covers are easily removed, installation being made with screws fitted into keyed clots. They may also be painted to match the color of the house.



Roomy "meter domes" accommodate installations up to 525 cu ft, are of Fibreglas, and have a "perma-sealed" reading window.



which soon looked slovenly and unattractive, although for a while it did serve its purpose of protecting the meter."

Mr. Blanding has been in close touch with the meter cover situation. At the last AGA distribution conference, the customer service subcommittee which he heads sponsored a display of meter covers and compiled a booklet which has been circulated among a number of utilities.

Along with Consumers Power Co., which standardized on the Handley-Brown model—partly because at the time no other wall-mounted types were available—more than 25 utilities have ordered boxes from this manufacturer.

Adequate protection?

How much protection do meters afford?

"It seems to be adequate with the meter covers that are available," says Mr. Blanding. "We believe the reason is that the meter tends to assume the temperature of the gas coming from the ground rather than the temperature of the outside air, when the load is on. This, we believe, is why the accuracy of the meters installed outside has, in most cases, been within 1% of that of inside installations.

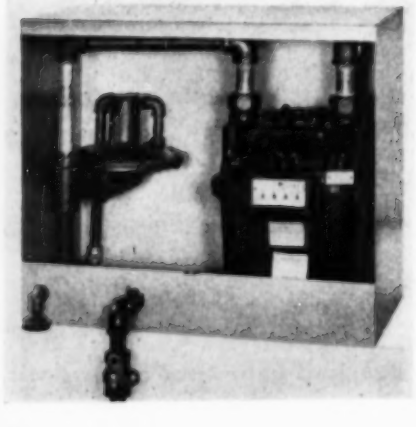
Moving meters

"Not many existing meter installations are being moved outside if the present location is satisfactory to the customer and the company. There are cases where, because of remodeling or because both husband and wife work, the customer is willing to pay for the labor and material involved in moving these installations outside."

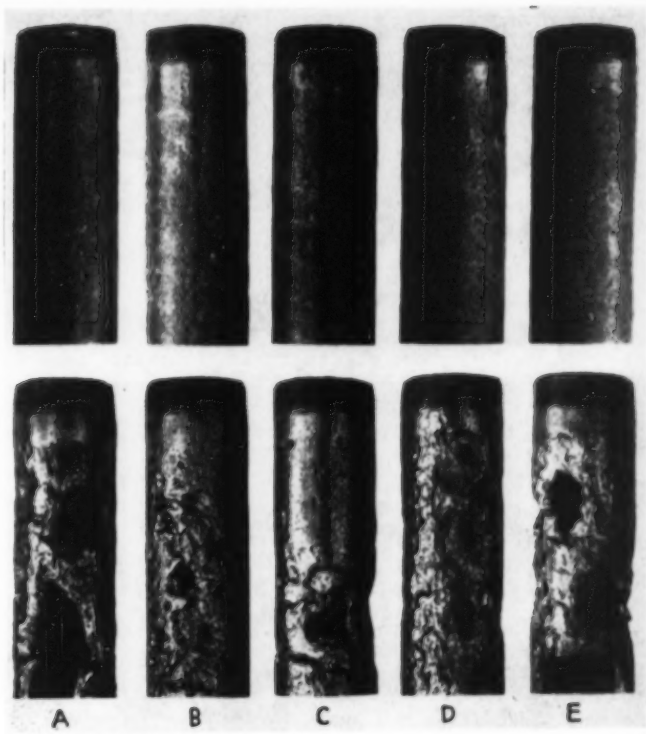
The question of who shall stand the cost of the housings is not well settled, but the general consensus favors charging the customer with the cost. Prices appear to vary from the manufacturer's price to lesser amounts with the utility absorbing a portion of the charge.

"Utilities generally feel that it is up to the customer to furnish a suitable location for the meter; therefore, it would follow that the customer pay for the meter cover, where either the box is requested or its installation is a necessity," says Mr. Blanding.

Consumers Power Co. had adopted wall-mounted covers in two styles—wall-attached and recessed. Vents are provided as shown. The deeper wall-attached models have ample space for accessory equipment.



NBS charts effects of corrosion on varying amounts of nickel in cast iron pipe



Cast iron pipe specimens after approximately 11 years' exposure to highly corrosive soils. The advanced state of corrosion is not immediately evident (top row) until corrosion products have been removed (bottom). Directly below each specimen in the top row is the same specimen with corrosion products removed. A was exposed to Lake Charles clay at El Vista, Texas; B to muck at New Orleans; C to tidal marsh at Charleston, S. C.; D to Docas clay at Cholame, Calif.; and E. to Merced silt loam at Buttonwillow, Calif.

THE National Bureau of Standards has recently completed a long-range study of the corrosion of nickel cast irons in soils.[1] From measurements on pipe specimens after exposure to different soil conditions for periods up to 11 years, it has been possible to evaluate the effect of varying amounts of nickel in the castings.

Corrosion of cast iron in soils is characterized by the development of an adherent layer of corrosion products that increases in thickness as corrosion progresses. The thickening of this layer is due in part to electrochemical action between the ferritic and graphitic constituents of cast iron and partly to differences in potential that arise from contact of the metal with the soil. In cast iron exposed to the air, addition of nickel or of nickel plus chromium to the casting has been found to give improved corrosion resistance by reducing galvanic action within the metal itself.[2] To determine the effect of such additions on the corrosion of cast iron in soils, the bureau included samples of nickel cast irons in an extensive series of exposure tests of materials for underground construction. With the completion of this work, data became available for exposure up to a maximum of 11 years for specimens of low-alloy cast iron, and up to a maximum of 14 years for specimens of high-alloy cast iron. In all, 16 exposure sites were employed, representing a wide variety of soils throughout the United States. After removal of the samples from the exposure sites, weight loss and depth of pitting were measured, and the resulting data were analyzed by I. A. Denison and M. Romanoff of the bureau's corrosion laboratory.

The study included samples of plain cast iron, low-alloy cast-iron pipe (1.27 nickel, 0.32 copper; 1.17 Ni, 0.98 Cu; 3.32 Ni), low-alloy cast-iron plate (2.08 Ni. 1.10 Cu; 3.10 Ni), and specimens of high-alloy cast-iron pipe (15.0 Ni, 6.6 Cu, 2.6 Cr). The specimens consisted of lengths of pipe 10 to 14 in. long and 1.5 to 2.5 in. in diameter. Moisture was excluded from the interior by means of cast-iron screw caps of the same composition as the pipe. As an extra precaution against internal corrosion, the inner surfaces of the specimens were coated with heavy grease.

Weight losses and depth of pitting were correlated with the composition of the specimens and the type of soil environment to which they were exposed. From the standpoint of both criteria, the high-alloy cast iron was considerably more resistant to corrosion than either the main cast iron or the low-alloy cast irons. Except in cinders, the deepest pit measured on the high-alloy specimens was only 74 mils after 14 years of exposure.

In the low-alloy cast irons, additions of nickel up to 3% were found to reduce initial corrosion in poorly drained soils of low resistivity, but this advantage was not maintained for the duration of the tests. Thus, the weight losses of the low-alloy cast irons exposed for the maximum period did not differ greatly from the losses of the plain cast iron. Hence, it would appear that the rates of corrosion of the alloys containing as high as 3% nickel decrease less with time than do the rates for plain cast iron and the alloys containing smaller amounts of nickel.

Measurements of hydraulic bursting pressure were also made on samples of the nickel cast irons after exposure to the different soil conditions. Because the original shape and appearance of the metal are retained, visual observation gives no indication of the extent of corrosion in cast iron that has been buried. It is generally recognized that corroded cast iron retains some of its original strength, but the extent to

ConEd will test proficiency of 4000 drivers

PROFICIENCY of Consolidated Edison Co.'s 4000 drivers is being checked by a driver-training program.

Safety is the program's keynote. The primary purpose of the New York utility's program is to make each driver as expert and as safe a driver as possible. Obviously, the company also gains from the maintenance point of view as the careful driver takes better care of his equipment.

All Con Edison drivers are trained to handle their equipment. They must pass fitness tests to qualify as operators of company vehicles. City and state requirements also have to be met.

The driver-trainer system is being used to avoid disrupting work routines. The trainers are experienced drivers selected from different company departments. They are put through an intensive five-day driver-trainer course planned and administered by Con Edison's transportation department and safety bureau.

Trainers ride with fellow employees in their respective departments. They observe how each driver handles his equipment under actual working conditions. Any discernible faults can be corrected on the spot. Refresher training or physical check-ups are recommended if there is doubt of a man's ability to meet the high standards essential for safe driving in congested streets.

The five-day driver-tester course features classroom sessions and field demonstrations. The curriculum includes a study of drivers' characteristics; a review of state and city traffic regulations; and the essentials of "defensive driving"—how to guard against the inexpertness or carelessness of others.

Also covered are the basic mechanics of automotive equipment; psycho-physical driver testing methods; driving skill testing techniques; and how to handle problem personalities among their students. Each trainer receives a comprehensive manual covering the complete course.

Driver-trainers are selected from the various departments involved to put the program's implementation at the departmental level where observation of driving proficiency can be a continuous process. However, in the case of small company groups with too few drivers to warrant designation of a departmental driver-trainer, the transportation department provides the instructor.

TABLE 1. HYDRAULIC BURSTING PRESSURES AND NUMBER OF PERFORATIONS OF PIPE SAMPLES

			Plain Casting Iron		1.27% Ni 0.32% Cu		0.98% Cu 1.17% Ni		3.32% Ni	
Soil	Exposure	Sample	Burst. pres.	No. of holes	Burst. pres.	No. of holes	Burst. pres.	No. of holes	Burst. pres.	No. of holes
	Years		lb/in²		lb/in²		lb/in²		lb/in²	
Lake Charles Clay (El Vista, Texas)	7.2	a	350	2	500+	1	.....	....	.....	....
		b	500+	1	500+	1	.....	....	.....	....
	8.7	a	500+	3	500+	1	500+	3	500+	2
		b	.....	....	500+	1	.....	....	500+	1
	10.9	a	500+	1	500+	1	.....	....	.....	....
		b	500+	5	500+	10	500+	6	500+	8
Muck (New Orleans, La.)	7.2	a	500+	1	500+	1	500+	1	500+	1
	10.9	a	500+	1	500+	1	500+	2	.....	....
Docas Clay (Cholame, Calif.)	7.2	a	500+	6	0	7	50	10	500+	3
		b	500+	5	200	5	150	6	.....	....
	8.8	a	425	4	500+	4	.....	....	500+	1
		a	500+	2	500+	3	375	4	500+	2
	11.0	b	500+	10	.....	....	225	6	500+	3
		c	.....	....	.....	....	.....	....	350	7
Mohave fine gravelly loam (Phoenix, Ariz.)	7.2	a	450	5	.....	....	500+	3	.....	....
		b	500+	2	.....	....	0	6	0	7
	8.8	a	500+	1	.....	....	500+	6	275	3
		b	.....	....	.....	....	350	4	500+	5
	11.0	a	500+	1	.....	....	.....	....	.....	....
Merced silt loam (Buttonwillow, Calif.)	7.2	a	500+	5	0	14	500+	6	500+	7
		b	500+	4	0	11	0	12	0	14
	8.8	a	.....	....	500+	6	0	12	0	12
		b	.....	....	425	8	500+	7	300	9
	11.0	a	500+	12	175	18	.....	....	500+	9
		b	50	16	500+	6	.....	....	.....	....
		c	500+	11	.....	....	.....	....	.....	....

which cast-iron pipe may corrode underground and still retain sufficient strength to withstand the pressures commonly used in water- and gas-distribution systems had not previously been estimated.

In order to evaluate the residual strength of corroded cast-iron pipe, the samples of pipe that had been removed from the more corrosive soils after the longer periods of exposure were subjected to hydraulic pressures. The screwcap on one end of each sample was replaced by a similar cap in which a fitting had been inserted, and the pipe section was connected by copper tubing to a hand pump of suitable capacity. The pressure was increased at the rate of approximately 10 psi per second until failure of the pipe occurred or the maximum pressure of 500 psi was attained. After the application of hydraulic pressure, the corrosion products were removed, and the condition of the specimens was evaluated in the usual manner.

After exposure at the test sites for periods up to 11 years and storage in the laboratory for approximately one year, most of the specimens withstood a maximum pressure of 500 psi, even though the subsequent removal of the corrosion products revealed numerous holes of various diameters *(Table 1)*. Most of the low values of bursting strength that were obtained probably were not accurate measures of the strength of the corroded pipe at the time of its removal from the soil since these low values may have resulted from oxidation of the corrosion products during storage or damage to the pipe in handling and shipment. Hence, it is reasonable to assume that undisturbed buried cast-iron pipe, even in an advanced state of graphitic corrosion, is able to withstand the minimum pressure required of class 150 pipe. The partial results of incomplete field tests of the bursting pressure of undisturbed sections of plain cast-iron pipe are in good agreement with the measurements made on the stored samples.

[1] For full technical details, see Corrosion of Nickel Cast Irons in Soils, by Irving A. Denison and Melvin Romanoff, J. Research NBS *51*, 313 (December 1953).

[2] W. A. Wesley, H. R. Copson, and F. L. LaQue, Metals and Alloys *7*, 325 (1936).

New acetylene process monitored by mass spectrometer

NEWEST method for production of acetylene is the "Wulff Process," which uses natural gas, ethane, propane, butane, or any LPG mixture as feed stock to yield a relatively low-cost, but high purity product. Advantages of the Wulff process, as demonstrated by the Wulff Process Co. in a commercial-size plant in Maywood, Calif., during the past two years, are many: cheaper raw material; lower capital investment; smaller physical size; low, self-generated energy requirements; adaptability to safe, automatic control. Unlike competitive processes, the Wulff process requires no associated oxygen plant, and since all cracking energy is supplied by burning process off-gas in automatic regenerative furnaces, low-cost power availability is not a plant location factor.

Consolidated Engineering Corp.'s newest analytical and control instrument has had an opportunity to share in the perfecting of this newest acetylene production technique. This continuous process-monitoring mass spectrometer, the Model 21-610,* has been used by the Wulff company in a number of ways, monitoring the various streams under a variety of imposed conditions.

The mass spectrometer was placed on stream in the pilot plant (the instrument is portable and requires only 110-volt power and a small amount of cooling water) and connected to a common manifold bringing together samples from 19 points of interest. Studies included the following:

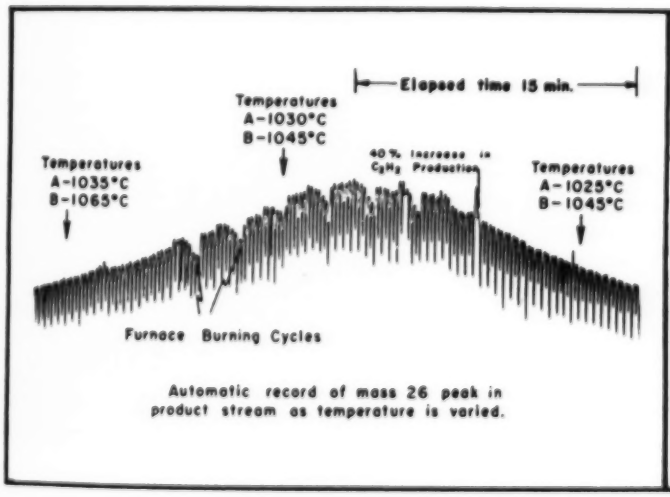
1. Monitoring the feed stock.
2. Cracking-gas composition versus temperature.
3. Fuel gas composition.
4. Acetylene or ethylene content of recycle gas.
5. Diacetylene scubber efficiency.
6. Acetylene or ethylene absorber efficiency.
7. Solvent recovery and/or loss.
8. Final product purity.

*See *CEC Recordings*, April 1953, or Bulletin CEC-1824 describing this model. It is available from Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Calif.

An example of the true value of on-the-spot continuous monitoring of a product stream is shown in *Fig. 1*. The mass-26 peak of acetylene was monitored in the cracking gas coming directly from the unit as the temperature of the furnace was varied.

From right to left the temperature of operation was slowly increased. The rise in the cyclically scanned 26 peak indicates rising acetylene content of the cracking gas, with peak height proportional to percent acetylene. Production of C_2H_2 increased approximately 40% in a period of 15 minutes with a temperature rise of 5° C.

The fact that the peak height drops when temperature is further increased indicates that formation of substitution products causes a drop in acetylene production. Furnace burning cycles are indicated by the periodic dip in the height of the 26 peak. Other similar tests have been run on full-scale twin furnaces and a definite relationship established between furnace efficiencies and reactor temperatures.



Automatic record of mass 26 peak in product stream as temperature is varied.

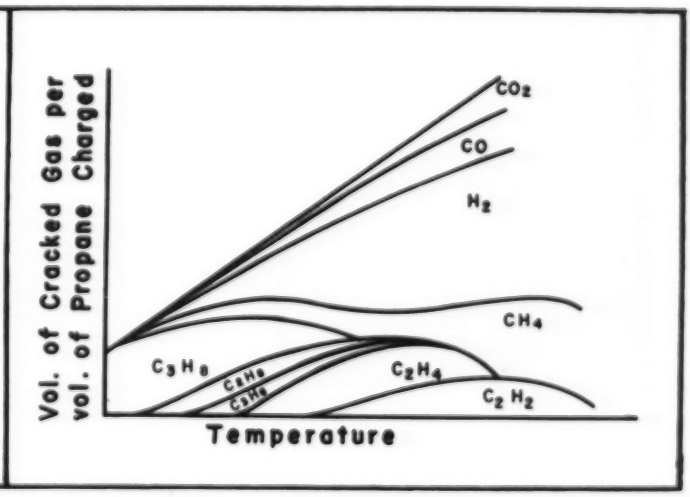


Fig. 1. A cyclic scan of the C_2H_2 peak as temperature was varied enabled Wulff engineers to determine operating levels for maximum yield.

Fig. 2. Composite yield curves plotted from 21-610 M.S. data make it possible to select operating temperature for any desired yield ratio.

Charles Williams, safety director of the Gas Service Co., Kansas City, Mo., shows safety course students how to use safety graph charts, part of course's teaching equipment.

AGA launches safety course

"ACCIDENT Prevention Through Informed Supervision," a new course offered by the AGA, is designed to give foremen, supervisors and superintendents a thorough grounding in modern accident prevention techniques. Launched by the association during its sixth annual accident prevention committee conference in Hartford, Conn., the two-day seminar restricts straight lecturing to a minimum, leans heavily on visual aids.

The course begins with a statistical survey of the gas industry's accident record and its position safety-wise in the nation's industrial community. This is followed by the two-day agenda: How to set up a safety program, how to make a safety talk, investigating and analyzing accidents, planning and conducting a safe operations meeting, methods of securing favorable worker response, how to maintain interest in a safety program, summary of entire course, presentation of regional or local plans and data, and a question-and-answer period.

Test conditions for the pilot run of the course at Fort Dodge, Iowa, were supplied by Northern Natural Gas Co. More than a hundred of Northern Natural's supervisors and foremen attended the schools at Amarillo, Texas; Wichita, Kan., and Fort Dodge.

The course is now being offered to regional gas associations. It works this way: Regional association finds that its accident frequency rate is out of bounds. The association canvasses its membership on the need for the course. With a positive vote, the association then asks the AGA's safety consultant, R. N. Papich, and his committee to set up a presentation of the course for its members at the regional point most convenient for the majority of attendants. Upon completion of these arrangements, member companies send their superintendents and other indicated supervisory personnel to the two-day course.

The course costs the regional association nothing. Costs to participating member companies will run about $20 per student. This will cover books, pamphlets, manuals, etc.

Attending the Fort Dodge pilot run were (l to r) L. F. Dippel, Northern Natural; R. N. Papich, AGA safety consultant; P. T. McDonaugh, Northern. At the rostrum is Marvin Travis, also from Northern Natural.

Other test procedures used in the study of the Wulff process with the Model 21-610 mass spectrometer involve periodic scanning of sevral critical peaks to establish acetylene or ethylene production versus tarring as measured by an increase in the substituted acetylenic compounds. Production versus temperature has been studied by periodic complete scanning of the spectra to establish material balances. An automatic programmer will allow continuous monitoring of the specific streams of interest.

Typical of the composite data that the 21-610 mass spectrometer enabled Wulff engineers to accumulate is shown in the family of curves *(Fig. 2)* representing graphically the composition of the cracking gas versus temperature on the basis of the volume of propane charged. It can be easily seen that as furnace temperature is increased, propane is first cracked to methane, followed by hydrogen, then propylene, ethane, ethylene, and finally acetylene at the higher temperatures. On the basis of such curves it is possible to select a temperature of operation that allows obtaining approximately any desired ratio of ethylene to acetylene along the lower curve (below which the acetylene content of the gas is indicated) and the ethylene, methane, hydrogen, CO and CO_2 above.

Phenomenal resolution of new cycloidal focusing mass spectrometer is discussed by Dr. Charles F. Robinson, chief physicist for Consolidated, and Frank Bumb (right), associate engineer.

GAS selected bibliographies

2. Storage—aboveground and underground

This is the second in a series of selected listings of articles that have appeared in GAS over the past 30 years, covering a broad variety of subjects of particular interest to the gas engineer.

1925

Adopting the Use of High Pressure Storage on a Large Scale, *Dec., p. 14.*

1927

Holder Station Design, Arthur F. Bridge, *Oct., p. 34.*

1928

Using Underground Reservoirs for Natural Gas, Arthur F. Bridge and H. P. George, *Oct., p. 28.*

1929

A Comparative Cost Study of Gas Storage Installations, Arthur F. Bridge, *July, p. 22.*

1931

Purging High Pressure Gas Holders, A. B. Allyne, *Jan., p. 24.*

1932

Gas Holder Maintenance, D. B. Larson, *Aug., p. 88.*

1933

Storage of Natural Gas in the Bow Island Field, P. D. Mellom, *May, p. 21.*

Gas Holder Maintenance, Thos. N. Kellett, *Sept., p. 70.*

Automatic Operation of Low Pressure Holders, Harry J. Smith, *Nov., p. 15.*

1935

Underground Gas Storage, J. A. Yunker, *Dec., p. 15.*

1938

Building An All-Welded Water Seal Gas Holder, John W. Burg, *March, p. 32.*

The Mechanics of Storage in Natural Gas Transmission Pipelines, P. E. Beckman, *Sept., p. 39.*

1939

A New Method for Building High Pressure Gas Holders, *Dec., p. 24.*

1940

The Underground Storage of Gas, *June, p. 23.*

The Liquefaction, Storage, and Regasification of Natural Gas, J. A. Clark and R. W. Miller, *Nov., p. 28.*

Liquefied Natural Gas: East Ohio Gas Co. Plant Will See Service This Month, *Dec., p. 24.*

1941

Building a High Pressure Holder, *Jan., p. 15.*

Regulation of Gas Holders in California, *Sept., p. 32.*

Regulation of Gas Holders in California, *Oct., p. 39.*

Water Seal Holder Built With a Sliding Joint, J. G. Rallow, *Nov., p. 25.*

1942

Underground Storage in California, *Oct., p. 66.*

Protecting Gas Holders Against Bombing Attacks, *Feb., p. 23.*

1943

Storing Gas Underground, *Dec., p. 41.*

1. Summary of Projects by States, O. D. Hall.
2. Field Tests for Determining Injection Volumes, Pressure, and Plant Capacity, J. H. Cable.

1944

Underground Storage of Gas, J. French Robinson, *June, p. 29.*

Underground Storage of Gas, E. G. Dahlgren, *July, p. 29.*

The Underground Storage of Gas, E. G. Dahlgren, *Aug., p. 43.*

East Ohio's Liquefaction Plant Destroyed, *Nov., p. 32.*

1945

Underground Storage at La Goleta, Raymond W. Todd, *Oct., p. 46.*

1946

Pre-stressed Concrete Tanks for Underground Gas-Oil Storage, *Jan., p. 34.*

Long Beach Looks to the Future, *May*

All-Welded 5-MMcf Low Pressure Holder, *p. 43.*

Design of All-Welded High Pressure Tanks, *p. 51.*

Erection Details of High Pressure Tanks, *p. 53.*

1947

Low-Cost Holders Made From Pipe, Frank W. Thompson, *April, p. 37.*

Underground Storage, E. L. Fischer, *Oct., p. 44.*

1948

Dual Purpose Propane Plant, Edward Titus, *Jan., p. 36.*

Low-Cost Holders Made From Pipe, Frank W. Thompson, *April, p. 37.*

Large Consumer Storage Pays Off in Utility L. P. Gas Development, Robert C. Smith, *April, p. 46.*

Oil Seal in Low Pressure Holders, Leon J. Willien, *July, p. 69.*

Wire Gauges Measure Stresses in L. P. Gas Tank, *Aug., p. 34.*

World's Largest L. P. Gas Plant, W. R. Fraser and I. Resnick, *Dec., p. 33.*

GAS selected bibliographies..2. Storage—aboveground & underground

1949

Underground Storage, H. J. Wagner, *Feb., p. 39.*

Reserves Report: 174 Trillion Cubic Feet, *April, p. 42.*

Underground Storage of a Propane-Air and Natural Gas Mixture, *Aug., p. 28.*

Mammoth Holders to Help PG&E Over Winter Hump, *Oct., p. 45.*

The Chicago Liquefaction and Storage Plan, *Oct., p. 92.*

A New Storage Method? (Technical Trends), Guy Corfield, *Nov., p. 25.*

Holders: Conventional, Pipe, and Bottle Types, W. C. Mosteller, F. A. Hough, and R. O. Randall, *Nov., p. 39.*

Storing Btu's for Peak Loads, Philip S. Parker, *Dec., p. 54.*

1950

Natural Gas Reserves Now Total 180 Trillion Cubic Feet, *April, p. 39.*

A Safer Way to Stockpile Natural Gas, C. V. Spangler, *May, p. 62.*

Line Pack Storage, W. C. Mosteller, *June, p. 85.*

L. P. Gas Storage Underground, *Aug., p. 23.*

Underground Storage and Migration of Natural Gas, J. J. Schmidt and F. E. Vandaveer, *Oct., p. 121.*

PG&E's Storage Goes Underground, J. W. Noble, *Nov., p. 79.*

L. P. Gas Storage Underground, *Nov., p. 21.*

1951

Drilling Rig: Important Tool of the Gas Transmission Company, *Feb., p. 77.*

Peoples Optimistic Over Storage Prospects, *April, p. 105.*

Record Natural Gas Production Fails to Match 1950's Gains in Proved Reserves, *April, p. 60.*

Economics of Natural Gas Storage, Ralph E. Davis, *May, p. 103.*

Flexible Two-Way Flow Achieved in Austin Field Manifold System, Chas. R. Hetherington, *May, p. 114.*

Gas Storage Accounting, A. A. Cullman, *June, p. 37.*

Storing Gas in Underground Water Sands, Ionel I. Gardescu, *Nov., p. 97.*

The Herscher Gas Storage Project, J. J. Hedrick, *Dec., p. 101.*

1952

Proved Reserves Now 194 Trillion, *April, p. 74.*

Storage of Gas in a Partially Depleted Oil Zone, John Riegle Jr., *June, p. 101.*

Potentialities of the Herscher Dome as a Gas Storage Reservoir, M. V. Burlingame, *June, p. 102.*

Propane Storage Underground, *Aug., p. 31.*

Peoples' Storage Project Gets Underway At Last, James F. Oates, *Oct., p. 140.*

1953

ConEd's Flotation Method Paints Huge Gas Holders in Record Time, *Feb., p. 42.*

Natural Gas-Propane Plant Shaves Washington's Peaks, *Feb., p. 50.*

Gas Reserves Reach 199 Trillion, *April, p. 62.*

151 Pools Now Storing 1292 Billion Feet of Gas, *June, p. 98.*

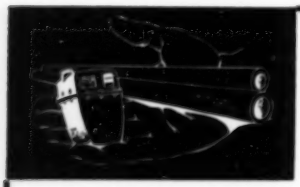
Herscher's Financing Problem: Who Would Own the Stored Gas? *June, p. 111.*

Assuring Integrity of Welds in Storage Pipes With Complete X-Ray Protection, H. P. Prudhomme, *July, p. 36.*

Economics of Peak Shaving Natural Gas, B. C. White and C. T. Chave, *Oct., p. 50.*

When Gas Leaks Spouted at Herscher, Public Confidence Did Not Waver, James F. Oates, *Nov., p. 33.*

Newly Patented Piston-Type Gas Holder, *Nov., p. 65.*



SHORT CUTS IN MATERIALS HANDLING: **4**

Self-leveling dock ramp

Michigan Consolidated Gas Co., Detroit, uses this hydraulic self-leveling dock ramp to expedite moving all classes of materials, with particular emphasis on fork truck operation. Use of the Wayne Pump Co. ramp eliminates the use of dock boards and allows the transfer of materials in bulk. The ramp accommodates truck beds of all heights within a range of 36 in. to 60 in. from ground level. The all-welded steel platform has 8-in. channel sides and cross members with ¼-in. safety tread plate top. It has a hinged throwover plate, 58 in. long by 14 in. wide in two sections with hinged self-leveling arm to provide floating action.

1955 officers: C. H. Zachry, 2nd vice president; F. M. Banks, president; E. H. Eacker, 1954 president; D. H. Mitchell, 1st vice president.

Operating section leaders for '55: F. A. Hough, SoCounties, 2nd vice chairman; W. H. Davidson, Transco, chairman; J. H. Collins, NOPSI, vice chairman.

Utilities must help free producer, AGA told

Adams warns conventioneers that producers battle to throw off FPC yoke is also utilities' fight; less gas at higher prices forecast

GAS staff report

A DIRECT challenge to throw off the cloak of complacency that blinds it to the perils of federal control was thrown at the gas industry in a key address at the 36th annual convention of the AGA, held Oct. 11-13 in Atlantic City.

K. S. Adams, chairman of the board of Phillips Petroleum Co., told the convention's general session meeting that many public officials and businessmen, including gas distributors and producers, fail to understand the effect of the Supreme Court's decision of June 7. In his opinion, this is due to misstated issues and a misled public.He would not hazard a guess as to whether these were intentionally created or were the result of lack of ability to analyze the situation.

Producers will not contract for the sale of gas when they know that the price they will receive will not necessarily be that stipulated in the contracts; hence, regulation by federal bodies means less gas at higher prices, Mr. Adams believes.

Mr. Adams charged the gas industry, particularly the gas distributors, with the fight to eliminate or overcome federal control by saying "I sincerely hope you will fight vigorously to assure a future gas supply for your customers and the continued growth of your industry."

The remarks of E. H. Eacker in his opening address to the general session were conservatively optimistic. Mr. Eacker is outgoing president of the AGA.

The new president, F. M. Banks, president and general manager of Southern California Gas Co., Los Angeles, stated in a speech before the industrial and commercial gas section luncheon on Tuesday, that gas cooks about 90% of the 70 million meals served daily in out-of-home eating establishments, but that this load is the one now under the attack of the most aggressive competition. To prevent this market from being destroyed in the gas industry, gas equipment for this application must be modernized. He called for all companies to use all resources available to get and keep industrial and commercial gas business.

One of the highlights of the general management section luncheon meeting was a paper by S. Whitney Landon, secretary, American Telephone & Telegraph Co., New York, titled "Our Friend the Stockholder," in which he declared that the subject of stockholder relations is of prime importance to any company because a company, like a person, has character and it is a duty that this character be interpreted to its stockholder-owners.

This meeting of the AGA was the first in Atlantic City at which there were no exhibits of products by gas appliance and equipment manufacturers. Many in attendance felt that this added to the effectiveness of the convention; however, a concensus seemer to indicate that the lack of exhibits tended to decentralize the purpose of the proceedings. Many felt that the meeting lacked a rallying point. Even transmission and producing elements, often thought to be divorced from the utilization and promotion phases, indicated that the appliances usually displayed brought home to them, in years past, that the results of their efforts were vested in end-point use of the product—gas!

Another idea often expressed along the boardwalk was that the distribution companies have carried the battle for the advertising, promotion, and sale of gas appliances with somewhat more aggressiveness than have other sections of the industry. Now. faced with the fierce and effective campaigns of competition, it is time for the producers and pipeline companies to redouble their efforts and join in the struggle for cooking, water heating, and space heating markets. Also, some feel that the industry associations must come closer together to produce better promotion in spite of the great strides that they have made.

Pilot model of radiamatic range unveiled at lunch

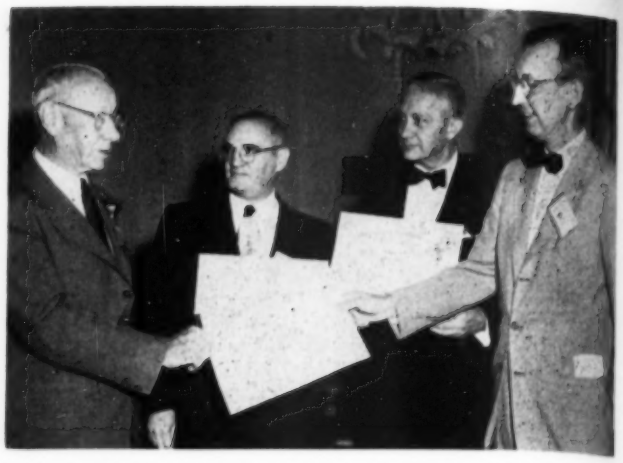
A PILOT model of its new radiamatic range was shown by the Geo. D. Roper Corp. at the Blue Flame luncheon at the AGA convention. The range features enclosed top burners with ceramic radiants designed to absorb heat from the flame of power burners.

Glass-like heads over the burner flames eliminate the need for metallic grates. The covers are practically flush with the table-top surfaces and give the appliance clean, smooth lines. All top burners are equipped with electric glow coil ignition, and feature a well controlled simmer section.

The housewife places her utensil directly on the transparent cover. As the burner is ignited, the clean blue flame is swept over the surrounding radiant to produce balanced radiant heat. She can control the intensity of the heat at will.

A small burner furnishes air under pressure as secondary air to the power burners. The combustion area is concentrated at the center of a circular radiant; however, the burner is designed to fan the flame over the entire surface when the housewife desires maximum heat.

Home Service award winners (from left): Marjorie T. Chandler, Eleanor V. Wiese, Dorothy Farrell, Ida Lansden, and Mary Louise Bohn.



H. B. Andersen presents operating section's award of merit to Louis Schnidman, Rochester Gas; G. R. King, Philadelphia Electric; and C. W. Wilson, Consolidated Gas.

The Beal medal went to Michael Anuskiewicz (left) and George C. Dormer for their technical papers.

Charles H. Mann (left) won the Distinguished Service Award and Earl J. Jacobs the Meritorious Service award.

Industry members paid tribute during Atlantic City convention

RECOGNITION was given by the AGA durings its annual convention to individuals for bravery, for outstanding technical work, for individual accomplishments in the gas utility home service field, for individual contributions to the general interest of the gas industry, and for the most outstanding contribution to the science and art of gas distribution.

Technical papers by Michael Anuskiewicz, engineer of development and planning for Brooklyn Union Gas Co., on "Development of an Overpressure Protection Program for a Distribution System," and by George C. Dormer, assistant chief engineer of the Manufacturers Light & Heat Co., on "Practical Problems of Odorization," were both deemed worthy of the Beal Medal award.

Earl J. Jacobs, of Michigan Wisconsin Pipe Line Co., Detroit, won the Meritorious Service medal for conspicuous bravery last October when he rescued a fellow worker overcome by fumes while cleaning a natural gas dehydration vessel.

The Distribution Achievement award was presented to Fred H. Bunnell, general gas distribution supervisor for Consumers Power Co., Jackson, Mich., for his work in utilizing appliance regulators on customers' systems to increase distribution system capacity at minimum expense.

Valuable contributions and advice on all tax problems of the gas industry, won Charles H. Mann, assistant treasurer of the Columbia Gas System, the Distinguished service award.

Five were honored for their accomplishments in the home service field. They are: Mrs. Mary Louise Bohn, Laclede Gas; Marjorie T. Chandler, Consumers Gas of Toronto; Dorothy Farrell, Manufacturers Light & Heat; Ida Landsen, Washington Light; and Mrs. Eleanor V. Wiese, Public Service Electric & Gas.

Thirteen companies won safety awards. Accepting are (l to r): Arthur Wallender, ConEd; C. D. Kantner, Citizens Gas & Coke Utility; J. J. Jacob Jr., Peoples Natural; E. E. Edmondson, Texas Eastern; E. C. Bryant, Mystic Valley Gas, accepting for North Shore Gas and Narragansett Electric; H. Downey, Southern Natural; P. E. Quinn, Elizabeth & Suburban Gas; T. Henry, East Tennessee Natural; C. J. Poppelreiter, Chicago District Pipe Line. Companies not represented: Cincinnati Gas & Electric, Wisconsin Power & Light, and Florida Power & Light.

Application of closed TV to pipeline control hit of AGA operating sessions

By J. FRED EBDON • Managing Editor

NATURAL gas pipeliners attending the 36th annual convention of the AGA were shown a complete, functioning electronic control system that might well be basic equipment in the future.

The demonstration was a part of the operating section's program and was one of the highlights of the convention. Those inside the Trimble room of the Hotel Claridge could see images of controls and the controlled equipment (each located in a separate room) through the medium of closed circuit television. The television equipment used projected the action of a dispatcher's office on one 4½-ft by 6-ft screen, and the resultant action on another screen of the same size. All of the television pictures were in full color.

General Electric engineers had installed the equipment to simulate a dispatch office in one room, and a gas-turbine compressor station in another. The two rooms were linked by microwave radio. Of course, both the dispatcher and the turbine station were removed from the room in which the audience viewed the demonstration.

The communications net included teletype, telephone, and radio message media. In addition, the dispatcher had all facilities necessary to start, control speed, and precisely regulate the operation of a simulated gas-turbine driven compressor.

For the purpose of the demonstration, the dispatcher's office was that belonging to a "Mid-Central Pipeline Co." Mid-Central's pipeline superintendent was shown in his office wondering how things were going on the line. With a mere flick of a switch, the dispatcher's office was projected on one screen—in full color, remember—and the audience could easily read the pressure records. The pipeline superintendent noticed that the pressure at the "Fort Mudge Station" was too high. Why?

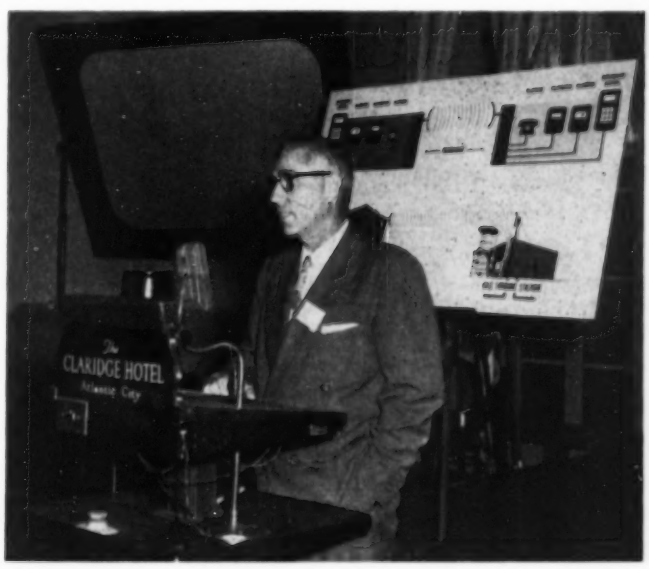
After the activation of a switch or two, the picture of the dispatcher's office showed the dispatcher talking to the superintendent. All conversation was clearly audible. They determined that warm weather had reduced the demand for gas, so it was necessary to take one of Mudge's turbine-compressors off the line. The compressor station office was then shown on one of the screens and the dispatching office on the other.

The audience, at its reviewing station, could then see the dispatcher walk to his control panel and push buttons that took the unneeded machine out of operation. All of the action, instruments, and gauges involved were under the supervisory control, visual and audible, of both the dispatcher and the superintendent.

Thus, those who attended this meeting saw everything required for the attainment of automation in pipeline station and line control; automatic station, supervisory control, a microwave link, and industrial TV. They saw the equipment—they saw it operate.

The concept of this equipment can be expanded to all properties of a pipeline system. Actually, the demonstration shown was a rather simple application—if the pipeline companies want to apply it to their headquarters, warehouses, local offices, etc., it can be done. It is looking into the future, but members of the convention were impressed by the fact the equipment to accomplish this is available now and the applications that have been made to date encourage further use of such methods.

A simulated dispatch office and a small part of the group that attended the demonstration of remote control equipment.



H. A. Rhodes of Transcontinental Gas Pipeline Corp., Houston, addressed the section on remote operation of systems.

The three BIG issues

By **SHELDON COLEMAN, President**
Coleman Co. Inc., Wichita

In "singing" the traditional "swan song" of an outgoing president, Sheldon Coleman, retiring president of GAMA listed the "three most important issues facing the industry today" in his address before last month's 36th annual AGA convention: the quickest and best way to execute the action program, the subnormal earnings situation among gas appliance manufacturers, and the threat of electrical competition to the gas heating load.

1. Action in a hurry

EXPERIENCE in the 10 demonstration "test cities" has given us the answer as to how we can best execute the Gas Industry Development Program. We now have the 267-page report of the firm of Fuller, Smith & Ross, based on the findings in the test city program, together with market studies and analyses and active participation in the tests.

Disclosures

Here's what the report discloses, first in its appraisal of utility sales operations:

The first general weakness was with the utility *sales department personnel.* On the whole, the sales personnel in the utilities was poorly compensated and, therefore, unhappy, or were self-satisfied, waiting out their retirement time. Really dynamic sales personnel was the exception rather than the rule in utility sales departments. The obvious remedy for this situation is better compensation for utility salesmen—an incentive plan of pay that rewards for performance—and dynamic sales leadership that inspires salesmen to do their best work.

The second weakness had to do with gas utilities trying to arrive at a decision to merchandise or not to merchandise. A clean-cut decision to merchandise or a clean-cut decision not to merchandise was preferable to an uncertain and vacillating policy in regard to this difficult question.

The third weakness in utilities, and this is almost a part of No. 2, was utility indecision—trying to decide whether to enlarge their own sales force or push dealer cooperative plans harder, or to do both. The important thing here again was to come to a decision and then actually *do something* to push the sale of gas appliances harder.

Exclusive franchises

Weakness No. 4. Many utilities still hold exclusive franchises despite a specific recommendation to the contrary in the AGA action program. The answer to that is simple—do away with exclusive franchises.

Weakness No. 5. There appears to be little evidence of well-conceived budgeting practices on sales, advertising and promotion. The answer to that is, there must be, if you are to have assurance that you are getting full value for your money. Such budgets must be constructed in accordance with the potential business which your area can absorb, and in line with the ultimate level of dealer cooperation which you must create.

Market potentials

Weakness No. 6. The establishment of market potentials and sales quotas is virtually unknown in the utility field. Without this knowledge there can be no really intelligent sales promotion or advertising programs; nor can there exist any bona fide and well-founded dealer programs. The answer is—take the cue from the 10 cities. Cause market surveys to be made—sounding and measurements to be taken—and then put the results to work.

Weakness No. 7. Is the lack of a fool-proof plan for getting truthful reports from dealers. Without such reports a utility is flying blind as to the true state of gas appliance business in its area.

Design for Selling ··· Profitably

ROPER GAS RANGES

Sell this Big Advantage

THE ROPER "DRY-AIRE" FULLY-AUTOMATIC GAS CLOTHES DRYER, TOO, IS PROFITABLE TO SELL

Ask about Roper Gas Ranges in Decorator Colors . . . Chrome Tops, too!

I'm interested in getting full details concerning the Roper franchise in my community.

Company Name.....

Individual's Name.....

Street Address.....

City.....State.....

G-11

GEO. D. ROPER CORPORATION
Rockford, Illinois

Sales Representatives in Principal Distribution Centers

The manufacturers looked no better than the utilities; in fact, we may look a little worse:

First—the manufacturer has been a hard nut to crack when it comes to providing the utility with money for cooperative advertising and sales promotional efforts.

Second—in these endeavors manufacturers have relied too much on lip service.

Third—too many manufacturers' representatives are not salesmen, but order takers and are unable or unwilling to provide dealers and utilities with selling or merchandising help.

Fourth—manufacturers have inadequate manpower to adequately service utilities, dealers and distributors. Many have not received a call from manufacturer representatives for as long as two years.

Fifth—manufacturers do not coordinate their sales promotion and advertising efforts with the national programs sponsored by AGA.

Sixth—manufacturers have failed to maintain in many cases proper communications with utilities, dealers and distributors, and have thus placed a barrier in the path of establishing sound dealer-utility relationships.

Seventh—manufacturers have failed to take full advantage of the cooperative merchandising helps offered by the gas utilities.

Manufacturers' job

Here is what we are asking each gas appliance manufacturer to do:

1. Delegate the Gas Industry Development Program responsibility to a capable executive—with authority to plan, make decisions and act.

2. Make sure that all important company personnel are educated and informed on the program.

3. If "action cities" are in the territory covered by a distributor, make sure the distributor and his dealer-contact personnel are completely informed on the program and understand their responsibilities.

4. Set up a communications system to your field organization to keep them informed on action-city progress and what you and your company are doing.

5. Decide upon your own special action-city cooperation plan. Make it special—not a rehash of available materials and offer manpower cooperation along with materials and plans.

6. Put your plan in kit form and make it an important presentation to the action-city utility executives and your dealers.

7. Adopt a policy and code for your action city operations in accordance with the spirit and the letter of the individual points of the AGA-GAMA Gas Industry Development Program.

8. Integrate your programs for the action cities as closely as possible with AGA programs being sponsored by the utility companies.

9. Use the action cities as "pilot" operations to test your plans to increase sales of your appliances. It's a chance for you to experiment and for the action cities to gain plus activities.

10. Keep a month-to-month sales performance record of accomplishments in each of the 10 action cities. Compare with previous accomplishments and do everything to stimulate greater action.

Plan and execute

We manufacturers intend to really do something about this situation. We have a good plan—execution is our problem. Now the gas utilities can help us by turning on the pressure for better performance.

How can this best be done?

It is spelled out in the joint AGA-GAMA Gas Industry Development Program passed unanimously by the AGA board of directors and also unanimously endorsed by GAMA. This direct quote reads as follows:

> "To insist that individual manufacturers shall bear their share of the responsibility for the upgrading and promotion of quality gas appliances; and to promote *especially* the products of manufacturers who give adequate attention to the improvement of their appliances and provide adequate advertising and promotional support for their sale."

The manufacturers are willing to accept that statement as the rules of the game, but all utility people (and this is of utmost importance) must be sure to play the game according to those rules.

This discussion of manufacturers brings me to the second part of my talk, for we manufacturers have maneuvered ourselves into a very serious situation. *I am referring to the subnormal earnings of the gas appliance manufacturing industry.*

2. The "subnormal earnings" threat

WHAT are the facts?

Tom Arden, the incoming president of GAMA, made a rather exhaustive study of this profit situation. The results are crystal clear. *Last year, five range companies doing a business of $1 million operated, as a group, slightly in the red.*

Taken as a whole, the earnings in the gas appliance manufacturing industry are from one-half to two-thirds of the earnings of manufacturers as a whole.

Now, what is the result of this?

Easy answer

It doesn't take any master mind to find the answer. Our industry just does not have the money for enough research, for enough product development—for in the long run the money for constructive future action must come from earnings.

What's the remedy?

Here again, the answer is easy to find. Our industry must stop competing on price alone. We must compete and compete hard but we must compete on quality. We must compete on service. We must compete on value. That's the kind of competition that is in the public interest.

When an industry starts competing on price alone, with each manufacturer striving to make a product a little worse and a little cheaper, that industry soon finds it is doing a great disservice to the public that it pretends to serve. Yet, that is exactly what has been happening in many parts of the gas appliance manufacturing industry and, in many cases, this cut-throat price competition has been encouraged by gas utilities.

Reward earned

The only place the money to improve our industry can come from is modest and fair earnings, and utilities can and should help. The process is very simple—just reward those manufacturers who do right—assist those manufacturers who compete on quality, service, and sales promotion. Help the manufacturers who have earned a right to your he'p.

DANGER TO THE HEATING LOAD →

VEILED BLONDE

New Sweetheart of the Heating Field

Humphrey HV-20, HV-40, and HV-60 Radiantfire Circulators in deluxe Veiled Blonde finish. 20,000, 40,000, and 60,000 b.t.u. capacities.

Same heaters also available in standard two-tone Opalescent Brown.

Heating dealers must be gentlemen. They have certainly shown overwhelming preference for this Humphrey "Veiled Blonde."

Acceptance of the great new "HV" line has been phenomenal, and an amazing percentage of orders have specified the deluxe Veiled Blonde finish. Our plant has been working to capacity to fill orders. We greatly appreciate this business. We are also grateful for your patience when deliveries could not keep up with demand.

Today, however, orders are being filled promptly and completely.

GENERAL GAS LIGHT CO., KALAMAZOO, MICHIGAN

Humphrey **RADIANTFIRE CIRCULATORS**

3. The heating load is in danger

WHAT equipment use in the American home will call for more energy units than all other appliances combined?

The answer is important and fortunately it is clear, simple and not even debatable.

This particular use is to climate control the air in the American home on a year-round basis. I use the term "climate control" because it is an all-inclusive term, covering heating in the winter, cooling in the summer, air conditioning the year round, with humidity control and cleaning and filtering of air.

Today, year-round climate control, or year-round air conditioning, costs less than an average automobile, and long term payments make the monthly installments smaller than payments on a car. No family that once experienced the comfort of year-round climate control in their home will ever give it up. Certainly, the day will come when the majority of homes in America will have it.

The question is, *how soon?* Some say five years, some 10, a few 20. The timing is probably somewhere in that range.

What form will year-round air conditioning take?

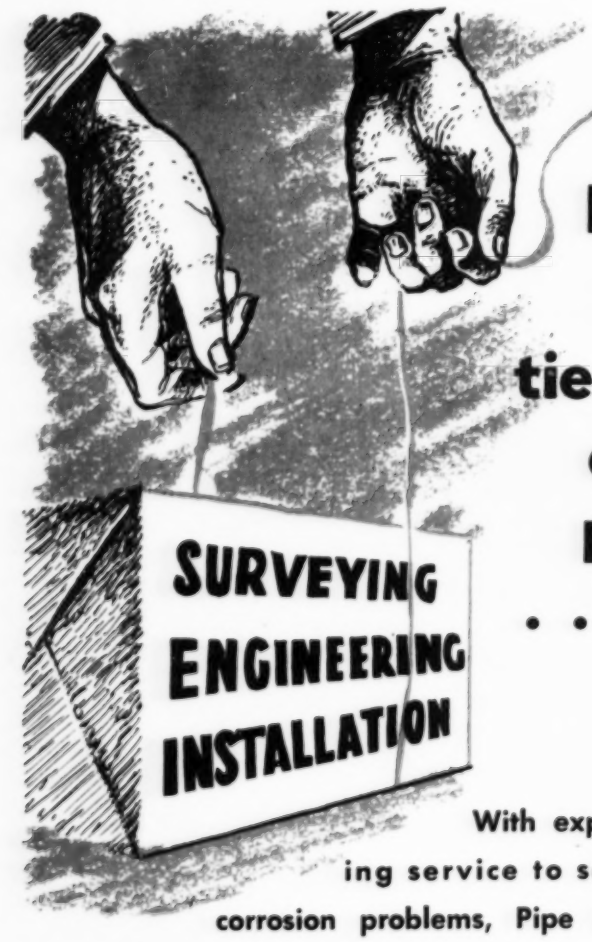
If you would ask the average-informed person today this question, he would probably say, that the home would heat with gas, and the cooling and air movement would be with electricity. That is the way the trends are running now. If it would actually work out that way it would not be disastrous for the gas industry, because the heating load would be retained. Of course, the gas industry would like the summer cooling load for these millions of American homes that will summer air condition, but with storage and other peak shaving devices the pipeline people could live and the gas companies could maintain profitable operations, with the heating load going to gas and the summer cooling load going to electricity.

Unfortunately, that's not the way it is going to be. The electrical industry is mobilizing all the power at its command (and hundreds of million of dollars are involved) to take on, not just the summer cooling load but the winter heating load as well.

Phillip D. Reed, chairman of the board of General Electric Co., in a published statement in the July issue of *American* magazine said this:

> *"At the moment the development that has us most excited is the heat pump.* It can cool your entire house in the summer, heat it in the winter and 'condition' the air all year long. To operate, it requires only air and electricity, no fuel or water. In the winter, believe it or not, the heat pump draws air in from the outside, extracts the heat from that 'cold' air (even when the air is below freezing) and uses that heat to warm the entire house! The heat pump, incidentally, eliminates the need for building an expensive chimney into your home.
>
> "When we first introduced the heat pump it was a luxury item. Within a few more years we hope to get the price down below $2000 per home. *Within a decade we expect to be selling more than 1 million of these heat pumps a year."*

Next, let us see what the electric utilities think of the heat pump in relation to the problem of electrical summer air conditioning without an offsetting winter load. Recently I talked with the presidents of three electric utilities, each of whom told me that last



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"We have to go after your heating load"

summer, for the first time, their summer electric load was substantially greater than their winter load and the continuation of this trend, as summer air conditioning grows, would place them in an impossible position.

It is impossible to build any rate structure that can come even close to justifying the generating and distribution costs to take care of this short, but violent peak that will inevitably occur when the majority of the homes in your area summer air condition with electricity. Don't think this is a little peak—we are talking about the Mt. Everest type of peak. The head of one midwestern electric utility in a city of half a million population stated when that first hot day hit, their demand jumped 80,000 kilowatts. Whole sections of electrical service suddenly went out—not just a few, but dozens of transformers blew. And yet, in that city, less than 5% of the homes at present are air conditioned with electricity. What if it were 50% or 75%? No wonder the president of that company called the president of the gas company in the same town and told him, "We have no choice, we have to go after your heating load through the heat pump unless you can find a better way to cool with gas."

Have the electric utilities a stake in the heat pump? I'll say they have. A multi-million dollar a year stake.

Three trends of the electric industry indicate great progress will be made during the next five years:

1. Many millions are going into technical research on the heat pump itself.

2. The breeder type of reactor for atomic energy will, in my opinion, give from 1- to 2-cent electricity in all parts of the U. S. now served by high-priced electricity. I am not referring here to the thermal reactor, but to the breeder type reactor, which Robert LeBaron, chairman of the military liaison committee to the Atomic Energy Commission, stated (in the June 25 issue of *U. S. News & World Report*), would be at least 100 times more efficient than our present thermal reactor. This whole subject of eventual cost of electricity produced by atomic energy is a complicated one, but if the rate of progress continues for the next 10 or 20 years that we have seen in the past 10 or 15 years, it would seem logical to expect a ceiling to be placed upon the price of electricity or less than 2 cents per kilowatt hour.

3. Electric utilities will have special rate structures to encourage year-round use of electricity to heat as well as to cool. As the out-of-balance electric summer cooling load skyrockets, pressures will be increasingly great to extend special inducements through the rate structure to get the year-round load of the heat pump.

All of these factors will add up, in my judgment, to the eventual offer on the part of our electrical competition of rates that range from 1 to 2 cents per kilowatt hour wherever the year-round use of electricity for both cooling and heating is installed.

When you couple a 1- to 2-cent electrical rate with a greatly improved heat pump, which may result from present research, then Phillip D. Reed's prediction of the sale of a million heat pumps a year on the part of the General Electric Co. no longer looks quite as fantastic as it did at first.

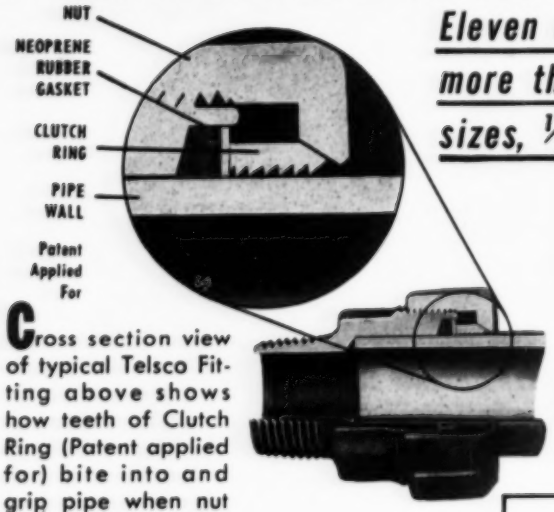
Yes, our gas heating load is in jeopardy—the threat is very real.

How important is the heating load to the gas industry?

On this I could quote many authorities, but will be content with just two.

Telsco

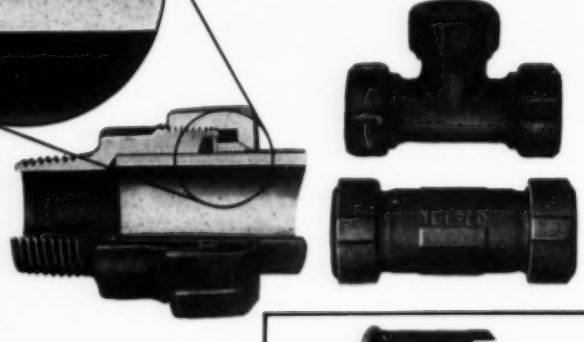
MALLEABLE IRON FITTINGS GET AND HOLD A BULLDOG GRIP ON STEEL AND PLASTIC PIPE



Cross section view of typical Telsco Fitting above shows how teeth of Clutch Ring (Patent applied for) bite into and grip pipe when nut is drawn up. The Neoprene Rubber Gasket, under pressure from the Clutch Ring on one end and the fitting body on the other, completely seals the connection against gas leaks.

Telsco Fittings are tested to hold at traction forces ranging from 1,450 to 3,600 lbs. They hold at hydrostatic forces ranging from 450 p.s.i. (on 2" pipe) to 8,250 p.s.i. (on ½" pipe)

Eleven different types, more than 100 different sizes, ½" through 2"



Metal Stiffeners

Telsco Brass Stiffeners to stop Thermoplastic "cold flow" are available to use with Telsco Fittings on Plastic Pipe. Stiffeners are split to allow for off-diameter pipe, and flared on one end to allow free flow through the connection.

Available in

Couplings (Long and Short), Adapters, 90° Elbows, Tees, Fitting Reducers and Fitting Increasers.

Literature

Complete information about Telsco Fittings: Ask for your copy of *Price List C*, just off the press.

TELSCO FITTINGS DIVISION
5423 REDFIELD STREET, DALLAS 19, TEXAS

THE SOLENOID VALVE

made for all gases

● MGSCo Solenoid Valves, Series EA, are made for all gases—even sour gas. All internal parts in contact with the gas are made of stainless steel or aluminum to prevent damaging corrosion. Valve bodies are made of cast, heat-treated aluminum alloy.

Straight through models are available in ½" female pipe thread inlet and outlet. A ¾" size is now being readied for production. If you want pilot tappings, they can be provided on either or both sides of the body. A pressure tapping can also be placed below the valve, or in the same place can be inserted a manual control screw to hold the valve open during periods of power failure.

For easy wiring, solenoid hoods can be turned 360°. Solenoid hood assemblies are replaceable. Conduit attaching nuts turn easily to facilitate attachment of the tubing.

The valve can be supplied in 20-volt models using transformer DA1 (two-terminal) or DA2 (three-terminal). Get the complete story by writing:

THE MILWAUKEE GAS SPECIALTY CO.
Dept. SC-2
MILWAUKEE 1, WISCONSIN

"We should develop an all-gas heat pump"

Gardiner Symonds, president of the Tennessee Gas Transmission Co., at our executive conference at Lake Placid, stated that the long pipelines were predicated on the heating load and could not exist and pay out from an economic standpoint without it.

The AGA committee on rates and economies, after a two-year study on the heating load, stated:

> "The acquisition and retention of house heating in *large volume* is an essential basic policy of the successful gas utility. Househeating is well on the way to becoming the major residential load classification of the industry."

What can the gas industry do? We can do two things:

First, develop an all-gas heat pump that cools in summer, heats in winter and uses gas to give the extra winter heat needed in most areas. After all, the heat pump is just the refrigeration cycle in reverse. It can be run with any prime mover, such as an electric motor or a gas engine, but the gas engine to compete must be sharply better—sharply different—than anything we know about today. This gas engine could be of the internal combustion type or an external combustion type, such as a thermal engine, or the hot air engine.

Who is going to develop such an engine?

I doubt if it will be the gas appliance manufacturers, although it might be, for some of us are trying. However, there may be only one source with sufficient resources to be sure to get the job done and that is the American Gas Association or a large group of powerful gas utilities combining with big pipeline companies. After all, the gas industry is the sixth largest industry in America. The money is there to do this development and research job if the companies involved are willing to lay it on the line.

What is the size of the bill?

That is hard to say, but a million dollars spent over a four-year period or $250,000 a year might be a minimum to start with—it is that kind of a job. A half million dollars a year would make success much more certain.

Why a gas engine cooling system?

Because it is the only gas cooling system that will combine with the heat pump. In addition, *the gas engine system is the most efficient with lowest operating costs for energy of all gas cooling cycles.*

A gas heat pump will compete with electricity even lower than 1 cent per kilowatt and, in general, there is no electricity in sight (except in a few government subsidized spots) that is any cheaper.

Now let's assume the country does not go heat pump crazy. Let's assume GE research fails to perfect the heat pump, or the public may always prefer regular gas furnaces for heating.

Has all the money to develop a better gas engine been wasted?

Not at all—*such an engine would be ideal in many areas to run a gas air-conditioning unit that could combine with conventional gas furnaces for year-round climate control for the American home*—for year-round gas load for the utilities—and for year-round production for the gas appliance manufacturers.

Our course of action is crystal clear —*the only question is, will we do it?*

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NOW 6 MODELS
Indicating Transmitting Liquid Gravitometer
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Ruggedly built for hard field use but with laboratory accuracy, the long accepted ARCCO-Anubis Liquid Gravitometer with all its splendid features is now available for recording, controlling, indicating, transmitting, or various combinations of these functions. Write us fully about your application and request Bulletin No. 111 Revised.
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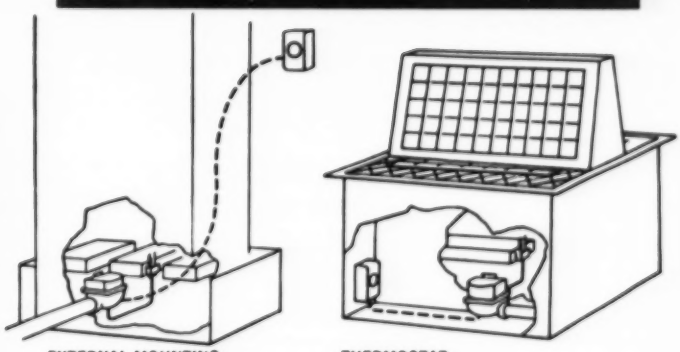
SEND FOR BULLETIN No. 111 REVISED

Here's **compactness** *and* **dependability** *in a* **low cost** *control* *...for small gas heating appliances*

BX 100

The above illustration does not show cable or bushing connectors furnished as part of the BX-100 set. The thermostat may be mounted with baffle in the cold air return or adjacent to small heating appliances.



EXTERNAL MOUNTING OF THERMOSTAT

THERMOSTAT IN COLD AIR RETURN

For automatic control of wall heaters, floor furnaces and console heaters the General Controls BX-100 self-powered control system can't be beat. Here in one system is thermostatic temperature, safety and flow control, completely independent of any outside power source. The BX-100 set consists of three elements. (1) The silent, compact automatic B-60R gas valve which operates in any position. (2) The G-250 (250 millivolts) generator adaptable to standard General Controls pilot burners. (3) The T-100 thermostat with General Controls exclusive thermopoised contacts. This control can be installed in a cold air return or can be located adjacent to the heater with cover and back plate for mounting.

Accessories include armored wire cables fitted with bushing connectors for easy installation of the G-250 Generator and T-100 Thermostat. Simple to install, completely self-powered and available with 100% automatic safety shutoff, you can't beat General Controls' BX-100 Control System for compactness, low cost and dependable operation in small gas heating appliances. For further information, request Bulletin SDI-BX100-1.

GENERAL CONTROLS

Plants in: Glendale, Calif., Burbank, Calif., Skokie, Ill.
Factory Branches in 38 Principal Cities
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications

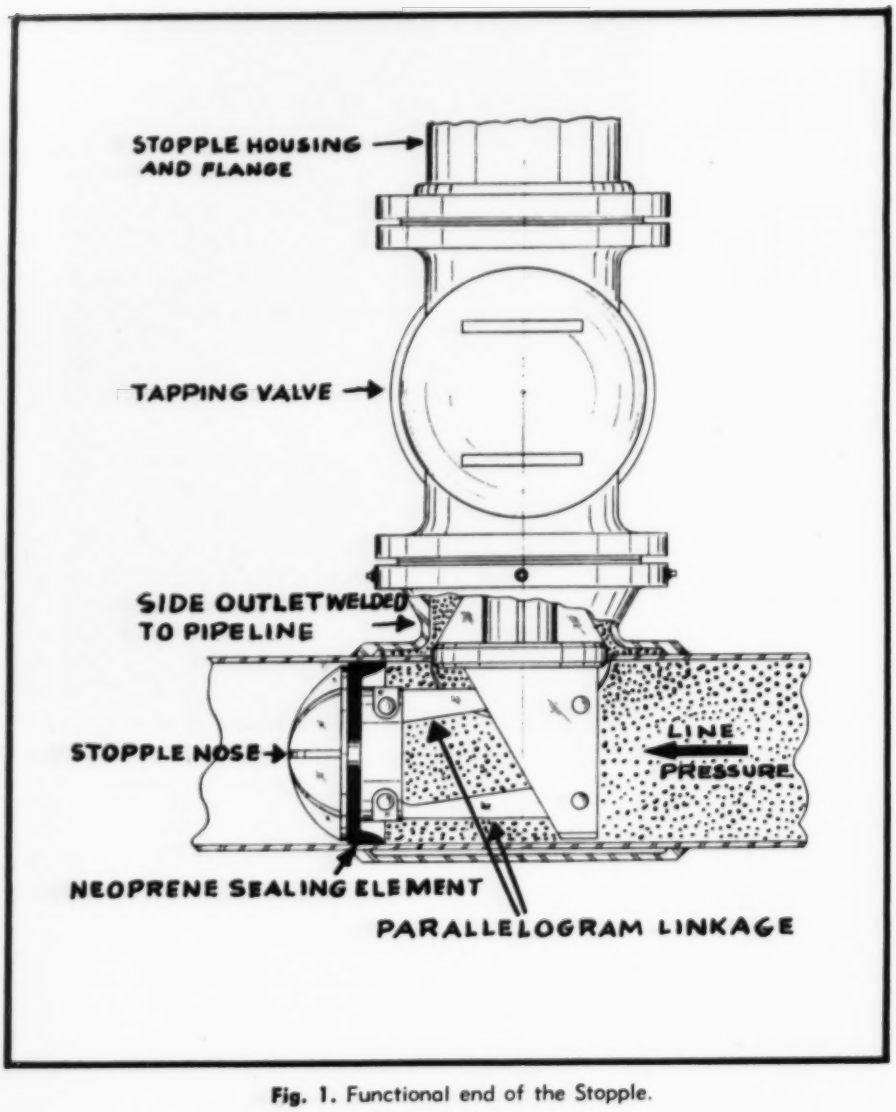


Fig. 1. Functional end of the Stopple.

New plugging device permits isolation of line

By JACK M. TILLMAN, Field Engineer
Kerr Engineered Sales Co., Pittsburgh

ISOLATING a large-diameter high-pressure gas line by plugging under pressure, a method that until recently was impossible because of the lack of appropriate equipment, has been accomplished with satisfaction and safety by The Peoples Natural Gas Co. of Pittsburgh. Peoples shut down a section of 14-in. pipeline under high pressure and completed a tie-in of a paralleling 20-in. section without interrupting service to three important cities.

The 14-in. line feeds the towns of Cresson, Tyrone, and Altoona, with some 33,000 domestic and industrial customers. The 30-in. line was already tied in at its terminus, but an additional connection was desired.

Since the only mainline valve was located at a point about three miles from the tie-in point, it was impossible to isolate the section without shutting off these three towns. To do this, of course, would be both costly and undesirable from a public relations standpoint. A bypass line could have been laid, but this would have involved obtaining right-of-way through populated areas, which also would have been both time consuming and expensive.

In order to accomplish the tie-in quickly and at low cost, Peoples used a newly developed tool, the "Stopple," which operates at pressures to 1000 psi.

The functional end of the Stopple is shown in *Fig. 1*. The sealing element is made of dual-durometer neoprene closely resembling a pipeline scraper cup. This cup and a steel nose, which provides strength and rigidity, are attached to a jack screw through a parallelogram type of linkage. When the sealing element reaches the bottom of the pipe, further movement of the jack screw and the operation of this linkage allow the sealing element to move longitudinally along the pipe toward the section which is to be depressurized. The seal is thus effected in the pipe itself. The dual-durometer feature of the cup allows for very flexible rubber on the outer lip to conform to any irregularities on the inner surface of the pipe and for very stiff rubber in the center portion to provide for the required strength.

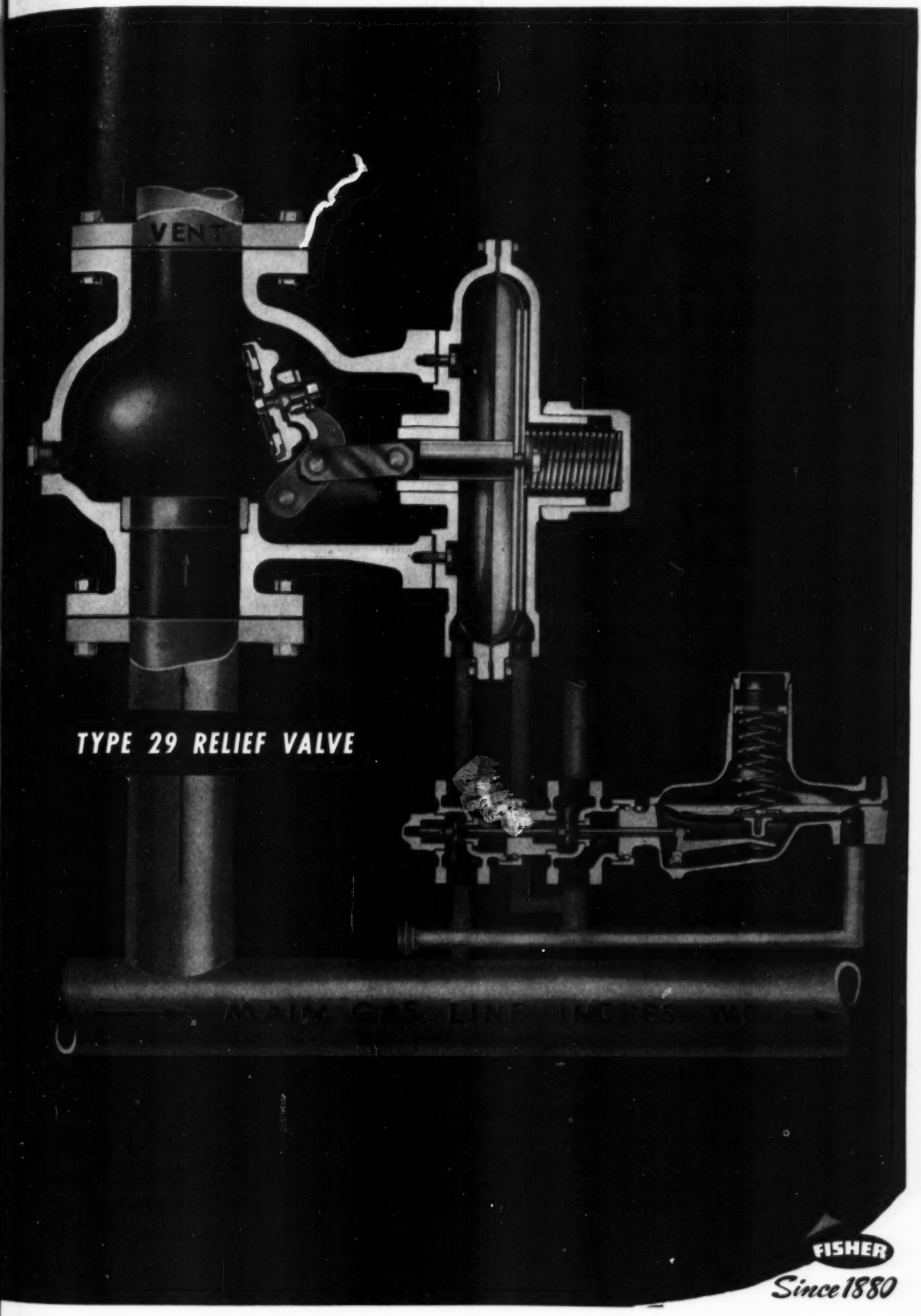
Since a hot tap approximately equal to the ID of the pipe was made, a special split tee was welded to the line to provide adequate reinforcement. Welded to this tee was a special type of flange in which four segments on the inner periphery of the flange could be moved radially inward. These segments engaged a special plug which was inserted into the flange, allowing for the removal of the gate valve upon completion of the job.

At the time the job was done, the pressure was 85 psig. After the Stopple was inserted *(Fig. 2)*, the section of 14-in. line was blown down, indicating that a satisfactory seal had been made. The line was then parted, and the necessary connections were made. After the Stopple had been removed, the special plug was inserted, by means of the tapping machine, into the flange on the split tee, *Fig. 3*. This allowed for the removal of the gate valve and the installation of a blind flange.

The entire operation, including the hot tap, insertion of the Stopple, the necessary work on the line, removal of the Stopple, and installation of special plug required approximately 7½ hours.

Summing up the advantages of using

GAS exclusive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Despite its thoroughness and over-all superiority, Connelly IRON SPONGE spreads its low cost thin through each 1000 feet of gas. To get the full facts about this effective purifier, write, wire or phone Connelly — today. Our engineering department is at your service.

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Fig. 2. Inserting Stopple sealing element.

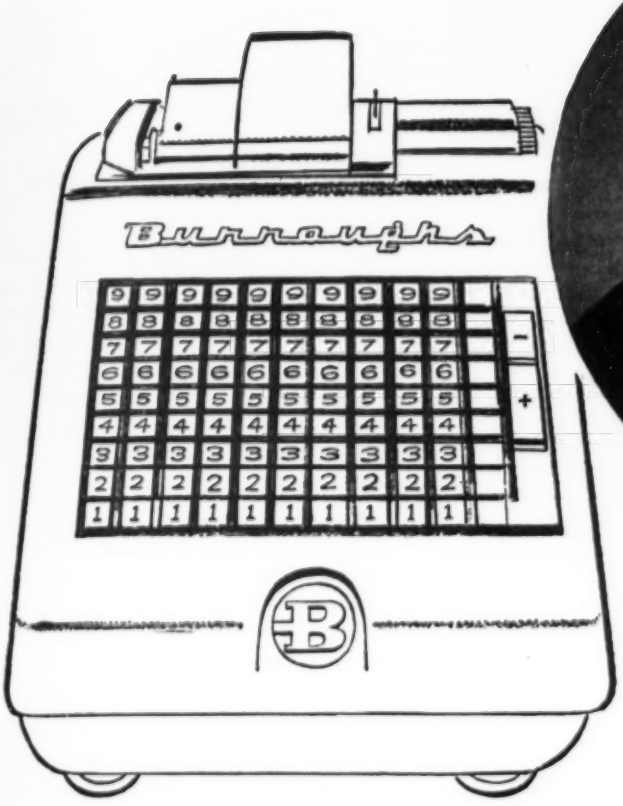
Fig. 3. Placing blind flange after plug holder has been removed.

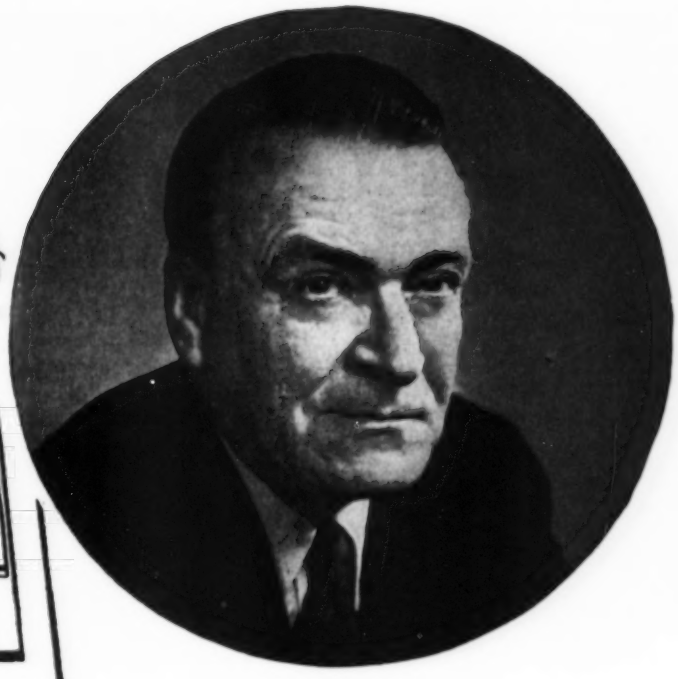
the Stopple, we can list them as follows:

Uninterrupted service was maintained to 33,000 industrial and domestic consumers, effecting a large saving in manpower and avoiding a considerable loss of revenue.

The need for 1½ miles of temporary bypass line through populated areas was eliminated. To obtain this right of way would have been time consuming and costly.

Very little gas was wasted by blowing off to the atmosphere.





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- **Prevent regulator from falling in a wide open position, thus limiting the amount of gas the safety seal has to pass.**
- **Enable the gas company to set the regulator for a certain demand and if a customer increases that, his outlet pressure would drop which would cause him to call the company and they can find out what his real demands are.**

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Thermally Thinking

Continued from page 26

Unfortunately, the producers have long looked at the situation as a one-way street. Be concerned about our problem, they warn the distributor; but are they concerned about his? How many producers are lying awake nights worrying about electrical competition? How many of their nickels have gone into the pot to help sell more gas ranges? Or to convince the customer that "here is the finest fuel, regardless of price — and if they start giving kilowatts away, you're still smarter and more modern when you cook with gas — *at any price*"?

Any way you slice it, the gas industry is still disjointed. And the producers cannot escape their full share of the blame.

An Eye on the Capital

FPC extends deadline to Dec. 1

The Federal Power Commission, after hearing vigorous pleas from representatives of more than 100 oil and gas companies that the commission grant a rehearing on its Order 174-A, has granted an extension of the deadline from Oct. 1 to Dec. 1 as the filing date for natural gas producers and gatherers, so that these companies might be regulated when they sell gas that goes into interstate commerce. Rate schedules and certificate applications must be filed by the Dec. 1 date, barring a further postponement, considered somewhat unlikely in informed circles here.

The principal arguments pressed by attorneys for the oil and gas producers against the FPC rules were:

1. The FPC has no authority under the Natural Gas Act to fix rates retro-

actively, as it did in freezing producer rates as of June 7, date of the Supreme Court decision in the Phillips case.

2. The Supreme Court's decision applied only to "all wholesalers of natural gas in interstate commerce," and, therefore, FPC's rules seeking control of all sales for resale by producers and gatherers of gas which might find its way eventually into interstate commerce exceeded the demands of the Phillips decision.

3. The Natural Gas Act exempted from FPC jurisdiction the physical properties involved in the production and gathering of natural gas, as distinguished from interstate sales for resale. Therefore, FPC rules nullify this exemption by undue extension of its control.

4. Producers and gatherers, regardless of these points, are not required under either the Natural Gas Act or the Phillips decision to obtain certificates of convenience and necessity from the Federal Power Commission in order to operate. As a result, the FPC rules are invalid to the extent that they would bring physical production and gathering facilities under federal regulation by using the certificate approach.

5. The Federal Power Commission has no authority to deny producers of natural gas an opportunity to withdraw, by means of an escape clause in a contract or by abandonment, from any transaction which would make them subject to FPC jurisdiction and would require FPC permission to abandon facilities never before certificated by FPC.

Members of the FPC, all during the two days of hearings, appeared to be generally critical of the lawyers who spoke for the companies, and particularly toward some arguments raised. The lawyers were warned not to waste time rearguing the Phillips decision, which some commissioners pointed out already has been decided by the Supreme Court.

Approximately 350 certificate applications and 1500 rate filings have been received by the FPC, under Order No. 174-A, but the FPC has stated that "in order to handle these filings in an orderly manner, it is desirable to extend the time requirement." FPC, incidentally, in the first formal ruling under 174-A, has held that the Texas State Drilling Co. need not apply for a certificate because the gas it produces for sale in Harris county, Texas, was shown not to be moving in interstate commerce.

Observers here expect the FPC soon to hand down a ruling denying the right of independent natural gas producers to invoke "escape clauses" in their sales contracts with interstate pipeline companies. After the Phillips decision, the FPC took the position that escape clauses were invalid unless FPC consents to the abandonment or withdrawal of the contracting parties, and producers were put on notice that any move to invoke such escape clauses would be challenged.

The first flouting of the FPC position came when Texas Illinois Natural Gas Pipeline Co. complained to the FPC that 14 Texas producers had invoked their escape clauses and would cut off sales to Texas Illinois unless restrained. It was believed that FPC would move to seek a court order to prevent this. At the same time, the commission is proceeding with specific authorizations to certain independent producers to sell gas to interstate pipelines, making authorizations to three independents in the same week here.

Continued on next page

low cost but more effective corrosion control with VIBRA-PAK anodes

Cost-wise a VIBRA-PAK anode system more than pays for itself through longer service life and controlled protection for buried or submerged metal structures. Here is a documented report, how VIBRA-PAK anodes minimize corrosion damage.

> **"We tried without success to find an anode with a core wire that would not pull loose in handling. Not until Standard Magnesium Corporation developed their "Perfect Anode Core" were our problems solved."**

—VIBRA-PAK anodes are spectrographically analyzed for metal purity . . . *your guarantee of longer service life!*

—a new, patented spiral core won't separate from anode . . . *positive contact is assured!*

—and remember, VIBRA-PAK means the anode is compacted and centered in the backfill through shipping, handling and placing it in the hole.

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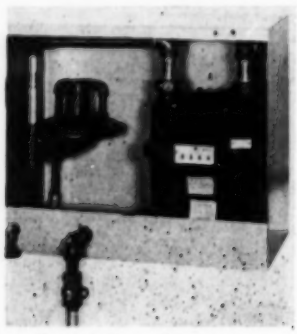
Improve customer relations! No servicing inside the house with the modern functional Handley-Brown All-Steel Meter Cover.

Saves time . . . meter reader can make up to twice as many calls . . . Costs much less to install than most basement gas installations.

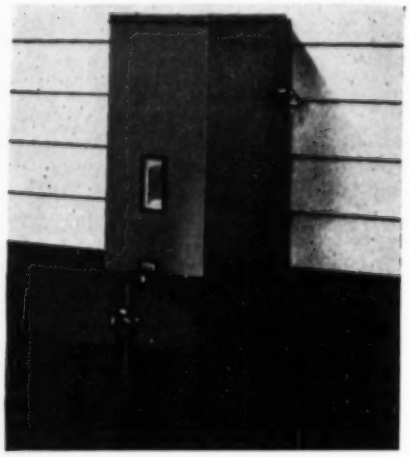
"Flush" Model



For New Homes

Inside view of the "Recessed" Meter Cover housing meter and regulator. Easily placed in position.

"Outside" Model



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More and more utilities are discovering "Poly-Trol" complete gas protection. Available for low, medium and high pressure installations. Also, in remote control applications.

Write for full details . . .

NOW **Handley-Brown**

POLY-TROL

Automatic Safety Shut-off Valves

PROTECTION AGAINST OVERPRESSURE AND EXCESSIVE TEMPERATURES

More and more utilities are discovering "Poly-Trol" complete gas protection. Available for low, medium and high pressure installations. Also, in remote control applications.

Cutaway view Showing Gas Shut-off

HANDLEY-BROWN HEATER CO., JACKSON, MICH.

Continued from page 71

Based on these authorizations, it seems that FPC orders, issuing certificates of public convenience and necessity to such producers, probably will contain a proviso that sales are authorized "together with whatever facilities subject to the jurisdiction of the commission may be necessary to consummate such sale or render such service . . ." Attorneys for producers have insisted that FPC has no authority to issue certificates for construction and operation of the "physical" production and gathering facilities.

"An assertion of power denied . . . by Congress"

Commissioner Digby, in dissenting from the FPC's attempt to certificate such physical facilities, stated: "The action of the majority . . . issuing a certificate for 'whatever facilities' is improper for it represents an assertion of power denied to us by Congress." Mr. Digby contends that the absence of such power was recognized by the commission itself in Orders No. 174 and 174-A, neither of which provided any procedure whereby application could be made for a physical construction and operation certificate.

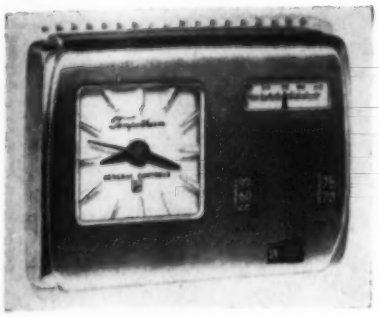
In another action here involving independents, the FPC authorized American Louisiana Pipe Line Co. to build the 1289-mile Louisiana-to-Michigan pipeline on condition that producers supplying the line submit to FPC regulation of their rates. (See Pipeline cover.)

The Phillips decision—and ramifications following it—has brought forth finally a concerted drive in the oil and natural gas industry for legislation to remove independent producers from federal control. Leaders have banded together in an organization called, "Nationwide General Gas Committee," of which Maston Nixon of Corpus Christi, Texas, is general chairman. He is president of the Southern Minerals Corp. The committee will try to drive through legislation similar to the Kerr Bill, vetoed in 1950 by former President Harry S. Truman.

Mr. Nixon, in a statement, said that legislative action is necessary in order to correct "the confused situation" resulting from the Phillips decision. He predicted a shortage of natural gas and rationing to consumers unless corrective legislation is passed.

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.



1 Day-Night Thermostat

The Tempothern, a new electric clock-type, day and night thermostat introduced by General Controls, automatically lowers and raises temperatures to assure comfortable sleeping levels during the night and warm rooms in the morning.

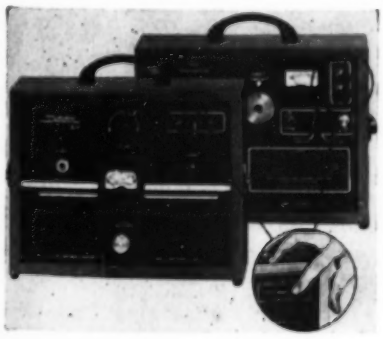
Two basic models are available for operation of 24-volt, 2-wire heating control systems. One is for modernization purposes and has a plug-in transformer to supply current for the clock, eliminating the need for extensive re-wiring.

The second model, for new construction, has a base that fits a standard 2-x-4 junction box mounted in a horizontal position.

Both are of contemporary horizontal design to conform with the modern style trend, and its silhouette is less than 2 in. Finger-tip roll dials with easy-to-read markings are provided.

General Controls Co.

■



2 Test Switch

For the instantaneous testing of both transmitter and receiver batteries, a new battery test switch has been engineered into the latest Model 505 pipe detectors produced by the Detectron Corp.

According to the manufacturer, the operator can now have positive assurance of maximum battery function at all times while detecting, tracing, and estimating the depth of buried pipes, cables, conduit, etc. By touching the test-switch, an immediate reading of battery condition is possible. The test-switch feature can be readily installed in older models of the detectors.

Other new features include the latest electronic tubes, a specially constructed vibration pickup for maximum sensitivity, an aluminum case, and the use of standard batteries.

Detectron Corp.

■

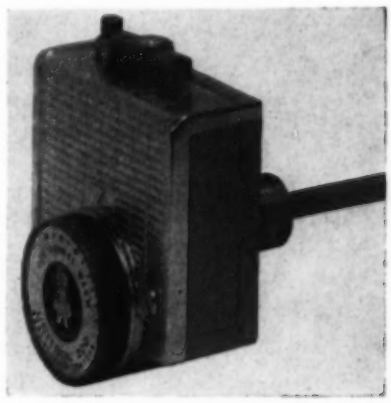
3 Sheeting Driver

A new, heavy-duty sheeting driver from Davey Compressor Co. is said to be highly effective for driving wooden sheeting in ground formations such as clay, sand, gravel, etc. Known as Model DSD-90, it can also be employed for driving light steel pilings.

The driver consists of a Davey-DB-90 paving breaker with an SD-90 sheeting driver attachment. Features include the Davey rocket valve with double trip ports for positive piston hammer action; chrome plating of the cylinder bore; extra large alloy steel bolts to hold the fronthead tight on the cylinder. Air-inlet swivel is a ground leak-proof joint, and a filter screen prevents foreign matter from entering the tool.

Davey Compressor Co.

■



4 Water Heater Control

Specially designed for mounting outside the water heater shell yet thin enough for easy concealment is Grayson Control's new water heater control. Shaped much like a cigarette case for ease of installation and, when necessary, concealment, the control, while different in size and appearance, retains standard components of the company's

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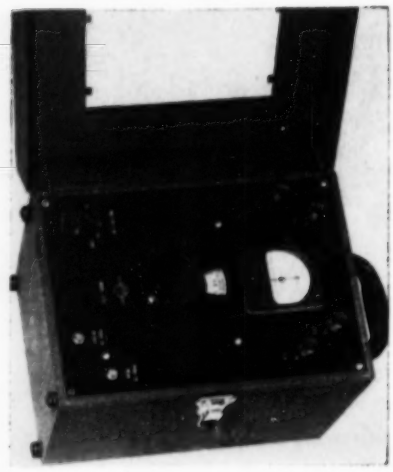
Unitrol controls, and has been designated the Unitrol 200.

The body is a die-formed pressure casting; it has a snap-on aluminum cover available in a wide choice of colors, as is the temperature dial.

The snap-on type temperature dial can be exposed while the control itself is located inside the water heater shell. When required, the control can be completely concealed inside the shell without special forming to the water heater jacket or door. It can be hidden in 2 in. of insulation. All parts likely to be serviced are readily accessible.

Grayson Controls Division

■



5 Measuring Instrument

Exploration to greater depths of the earth's substrata by electrical resistivity methods is claimed for a new earth resistivity measuring instrument, the Vibroguard, developed by Associated Research Inc.

The small, self-contained instrument uses the four electrode ac fall of potential method and reads resistance directly on a large, dial-type potentiometer calibrated to an accuracy of 1% of full scale. Model 274 employs a dry-cell, battery-operated vibrator type power supply. Measuring circuit is basically an ac bridge. Readings are obtained by balancing a galvanometer type of null detector, and are independent of contact and lead resistance.

Model 274 is housed in a rugged steel carrying case and weighs approximately 20 lb.

Associated Research Inc.

■

6 Plastic Pipe

A new lightweight flexible plastic pipe has been developed by Quaker Rubber Corp., a division of H. K. Porter Co. Quaker plastic pipe (Series 200) is made of 100% virgin polyethylene resin and guaranteed to be non-toxic. It will not rot, rust or corrode, is easily handled, and requires no special tools to install.

Quaker Rubber Corp.

■

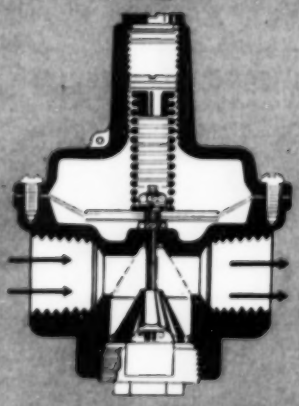
7 Angle Valve

The new packless Demi Model AM angle valve with the male inlet connection and female outlet connection has been announced by G. W. Dahl. The same packless construction can also be supplied in straight-through design with multiple ports or in a two- or three-valve manifold in brass, aluminum, steel, and 303 SS.

Demi Model AM can be equipped with panel mount bonnets, tee handles or round handles (as shown), toggle actuated, or with diaphragm operators for remote control. In brass and aluminum, the valve is rated for vacuum or 750 psig. In steel or stainless steel, it is rated for vacuum or 1500 psig.

AN INDUSTRY WAITED

It was an era of unprecedented development—almost everywhere. Commercial gas and Fulton shared their infancy. The industrial revolution and Jesse James made their appearance. So did Mrs. Murphy's cow. Teddy Roosevelt charged San Juan Hill. The Model T, Marconi and Flappers left their impression. Jets, radar and Uranium became schoolboy words. Yet, during this century and a half of progress, nobody bothered to change basic gas regulator designs. That is, until 1949—when "STRAIGHT-THRU-FLOW" was created at MAXITROL. This one advanced design opened new doors of efficiency and economy in gas regulation. That's why MAXITROL is truly the . . . Hallmark of Gas Heating Progress.



MAXITROL COMPANY

12200 BEECH ROAD • DETROIT 39, MICHIGAN

STRAIGHT-THRU-FLOW
(U.S. Pat. No. 2,668,396)

Sold on the Pacific Coast by PACIFIC SCIENTIFIC CO., San Francisco, Los Angeles, Seattle, Portland

The valve is normally supplied with an integral seat, SS diaphragm, and teflon gasket. It can also be furnished with neoprane diaphragm for 300 psig service.

G. W. Dahl

■

8 Service Saddle

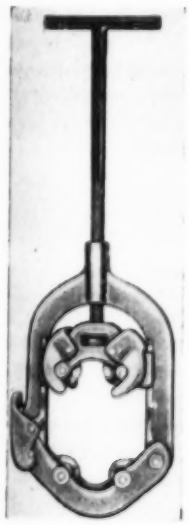
Dresser Manufacturing division is producing a new service saddle (Style 91) for tapping asbestos-cement, cast iron and steel pipe. Available in sizes from 2-in. ID through 12-in., the saddles come either heavily galvanized or with an economical special plastic dip that is non-toxic, does not "plate out" and has dielectric strength.

Other features of the Dresser service saddle include the flat straps with rolled threads, which give greater bearing surface on the pipe to prevent cutting or crushing. Special Dresser rubber compound gaskets are cemented into place.

Dresser Manufacturing Division

■

9 Pipe Cutter



Complete new design is featured in Reed Manufacturing Co.'s cutters for large size cast iron or steel pipe. Offered in several sizes to cover the complete range from 2½ in. to 12 in., the new Reed cutters feature a hinged yoke construction which calls for the minimum of digging in ditch work and eliminates "spring" from the tool.

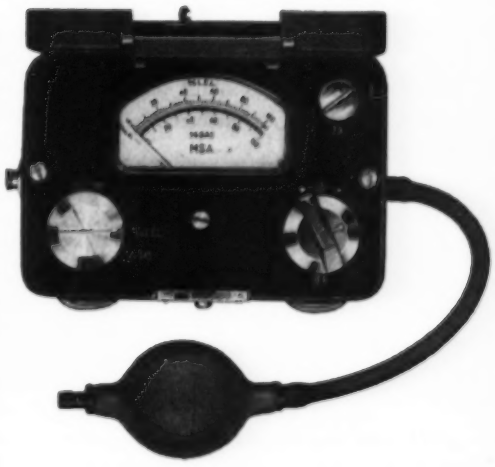
The use of four Reed razor-blade wheels speeds cutting. The special design of Reed wheels rolls down the outside burr on steel pipe and eliminates any need for filling. Wheels for steel or cast iron pipe can be quickly interchanged. A patented, four-

% L.E.L.
% GAS
This setting gives you 0 to 100% of lower explosive limit
..TURN THE SWITCH
% L.E.L.
% GAS
This setting gives you 0 to 100% by volume of combustible gas

This New Simplicity —New Versatility in ONE instrument ...the M·S·A GASCOPE

The illustration above shows you how, with the simple turn of one selector switch, the M.S.A. Gascope gives you both high sensitivity for the detection of low gas concentrations, and immediate, quantitative response for tracing higher concentrations of gas to its source. Separate scales for each range are calibrated on the fan-shaped meter in the center of the instrument. Each scale is divided by 50 graduations to permit accurate, fast readings.

This dual-range, direct reading instrument is the modern answer to fast, dependable detection and location of gas concentrations over the entire range from 0 to 100% by volume. Write for details, or ask for a demonstration. Your request will be handled promptly.



The Gascope is light, comfortable, and demands no special skill to operate. A variety of accessories are available to meet all sampling conditions.

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SAFETY EQUIPMENT HEADQUARTERS

Call the M.S.A. man on your every safety problem... his job is to help you

MINE SAFETY APPLIANCES CO.
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Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.
Representatives in Principal Cities in Mexico, Central and South America
Cable Address: "MINSAF" Pittsburgh

point pipe guide automatically positions the tool for a right-angle cut.

Reed Manufacturing Co.

■

10 Steel Meter

Measuring only 10¼ by 7 5/16 by 7 5/16 in., a compact new 60-cfh welded steel meter is now being offered by American Meter Co.

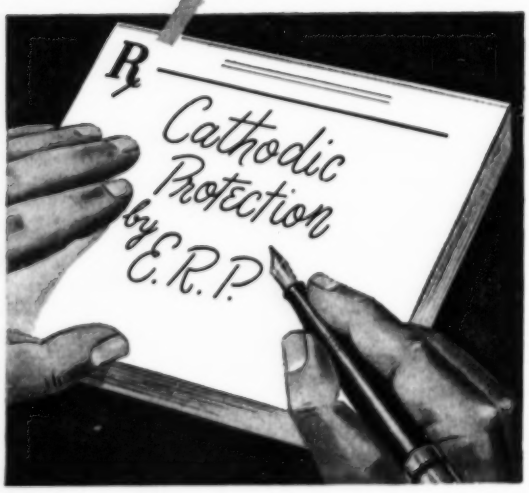
American has designed the new meter (W-60 series) specially for small load applications, such as apartment type loads and single dwellings where househeating is not involved. The new meter has ample capacity to cover the maximum hourly demand for these loads, yet is low enough in capacity to permit use of the most suitable valve design to assure accurate measurement of pilot loads.

The W-60 series meter is approximately one-half the size of a standard American 5M tinned steelcase meter and is particularly adaptable to group or bank installations where space is at a premium.

American Meter Co.

■

R FOR CORROSION...



You don't need a specialist to *recognize* Corrosion. But you do need one to treat it successfully. The skill required to achieve complete corrosion control comes only from the knowledge and experience gained through years of practical application.

Recognition of that fact is one reason more and more people are turning to E.R.P. for assistance on corrosion problems — one reason that thousands of buried or submerged steel structures of all types have been successfully protected against corrosion by E.R.P. engineers. Corrosion specialists *for over 17 years*, these men are highly trained and well equipped to help you with *your* corrosion problem. Write for full information today.

COMPLETE CATHODIC PROTECTION SERVICE • DESIGN ENGINEERING MAINTENANCE INSTALLATION EQUIPMENT

ELECTRO RUST-PROOFING CORP. (N. J.)
BELLEVILLE 9, NEW JERSEY
REPRESENTED IN PRINCIPAL CITIES IN THE UNITED STATES

E-27

Trade Literature

11 Revised Catalog

A newly revised catalog has been issued by Norton-McMurray Manufacturing Co. The 12-page catalog contains information on couplings and sleeves, self-locking joints, ells, tees, compression end cocks, meters bars, bell joint clamps, brass fittings, and other Normac developments.

Norton-McMurray Manufacturing Co.

■

12 Coating Catalog

Haartz-Mason Inc. has added a sheet to its catalog of industrial coated fabrics. The new sheet contains specifications and descriptions of 11 recent additions to the company's line of fabrics designed for use in the gas, controls, petroleum, automatic, aviation and various other fields.

Haartz-Mason Inc.

■

13 Valve Bulletin

Solenoid valves for high pressure applications are described in a four-page bulletin released by Atkomatic Valve Co. The literature illustrates features of Atkomatic bronze or stainless steel high pressure-pilot-operated and direct-lift solenoid valves with diagrams of electrical circuits used for normally open and normally closed operations.

Atkomatic Valve Co.

■

14 Vibration Bulletin

Type 1-110B vibration meters and associated equipment are described in a new bulletin published by Consolidated Engineering Corp. The four-page color bulletin contains specifications, operating information, and descriptions of input and output equipment.

Consolidated Engineering Corp.

■

15 Valve Pamphlet

A new 20-page, two-color illustrated pamphlet entitled "Choosing the Right Valve" has been issued by Crane Co. to serve as a

refresher in the application of basic valve designs for specifiers and buyers of piping equipment. Among the subjects covered are the three principal valve types, basic gate and globe valve design, two basic types of check valves, names of valve parts, gate valve seating designs, and many others.

Crane Co.

■

16 Flowmeter Bulletin

Commercial Research Laboratories has issued a four-page customer bulletin and supplementary literature covering the design features, maximum flow capacities, maintenance requirements and mounting drawings of the new Cox Type 12—90 Series multiple stage flowmeter. The bulletin, No. 1052, contains technical data and illustrations.

Commercial Research Laboratories Inc.

■

17 Catalog List

Bulletin 100-C lists all current Honeywell industrial division literature. Numbers and titles of all catalogs, bulletins, specification sheets, and instrumentation data sheets are included.

Minneapolis-Honeywell Regulator Co.

■

18 Telemeter Bulletin

A new expanded edition of Bulletin M1710 illustrating and describing the company's complete line of Metameter telemeters and accessories has been published by the Bristol Co. In addition to telemetering over telephone circuits, carrier current, and private wires, the 44-page bulletin features microwave telemetering, telemetering with selective calling, and time multiplexing telemetering.

Bristol Co.

■

19 Burner Bulletins

Several catalogs are available from Eclipse Fuel. (When ordering copies, use letter preceding description along with number of this notice.)

(a) Catalog H-65 describes the company's series "PBO" tunnel burners, which are for use with any complete gas/air mixture up to 10 in. MP.

(b) Catalog H-64 describes the company's piloted entrainment burners, which are suitable for a variety of heavy-duty applications including forging, heat-treating, boiler firing, etc.

(c) Catalog H-29 describes the Eclipse Burmix burner, which is a combination blast burner and proportional gas-air mixing assembly. It is particularly suited for converting oil-fired equipment to gas.

Eclipse Fuel Engineering Co.

20 Bell Holes Like This in One Day with a SHERMAN POWER DIGGER!

"Pay for themselves faster than most of our other equipment!" That's what R. Mannino & Sons, Westfield, New Jersey general contractors say about their Sherman Power Diggers.

A typical Mannino job was for the local gas company. Replacement of clamps and seals on gas mains required digging a series of bell holes. The Sherman Power Digger reduced digging time for the average bell hole to about fifteen or twenty minutes, making it possible to replace as many as twenty clamps a day.

If you now excavate by hand, or if your heavier equipment cannot work in tight spots, you, too, will find the versatile Sherman Power Digger practical and profitable. It's compact, flexible, fast, easy to operate. It digs in a fraction of the time and cost of manual labor—as deep as 10′ below grade in mud, hard-pan, shale, oiled roads, blacktop and stony ground.

Initial cost of the Sherman Power Digger is surprisingly low, maintenance simple and inexpensive. Write today for the whole story. Ask for Bulletin No. J-15.

Designed, Engineered and Manufactured Jointly by
SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan
WAIN-ROY CORPORATION
Hubbardston, Mass.

Patent No. 2,303,852
Other patents pending
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Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN

NEWS

Virginia companies ask for escalator clauses

Seven Virginia gas companies have asked the state corporation commission to permit escalator clauses in their rate schedules so that any increase in the wholesale price of gas may be passed on to consumers without another hearing before the commission. The commission has already approved one such request—that of Washington Gas Light Co.

The seven companies are Petersburg-Hopewell Gas, Lynchburg Gas, Portsmouth Gas, Virginia Electric & Power, and Virginia Gas Distribution Corp.

The plan as proposed would also require any reduction in the wholesale price of gas to be passed on to consumers.

Hurricane-delayed conversion gets under way

Conversion of Consolidated Edison Co.'s 100,000 customers' gas appliance in the east Bronx got underway late in September after it had been delayed because of a threatened hurricane.

Working south from Pelham, about 1000 men will convert the area in about two months. They will then move across the Bronx river. When all gas appliances have been converted in that borough, the men will move on to Manhattan. In all, the job involves conversion of about 1,438,000 appliances for more than a million customers.

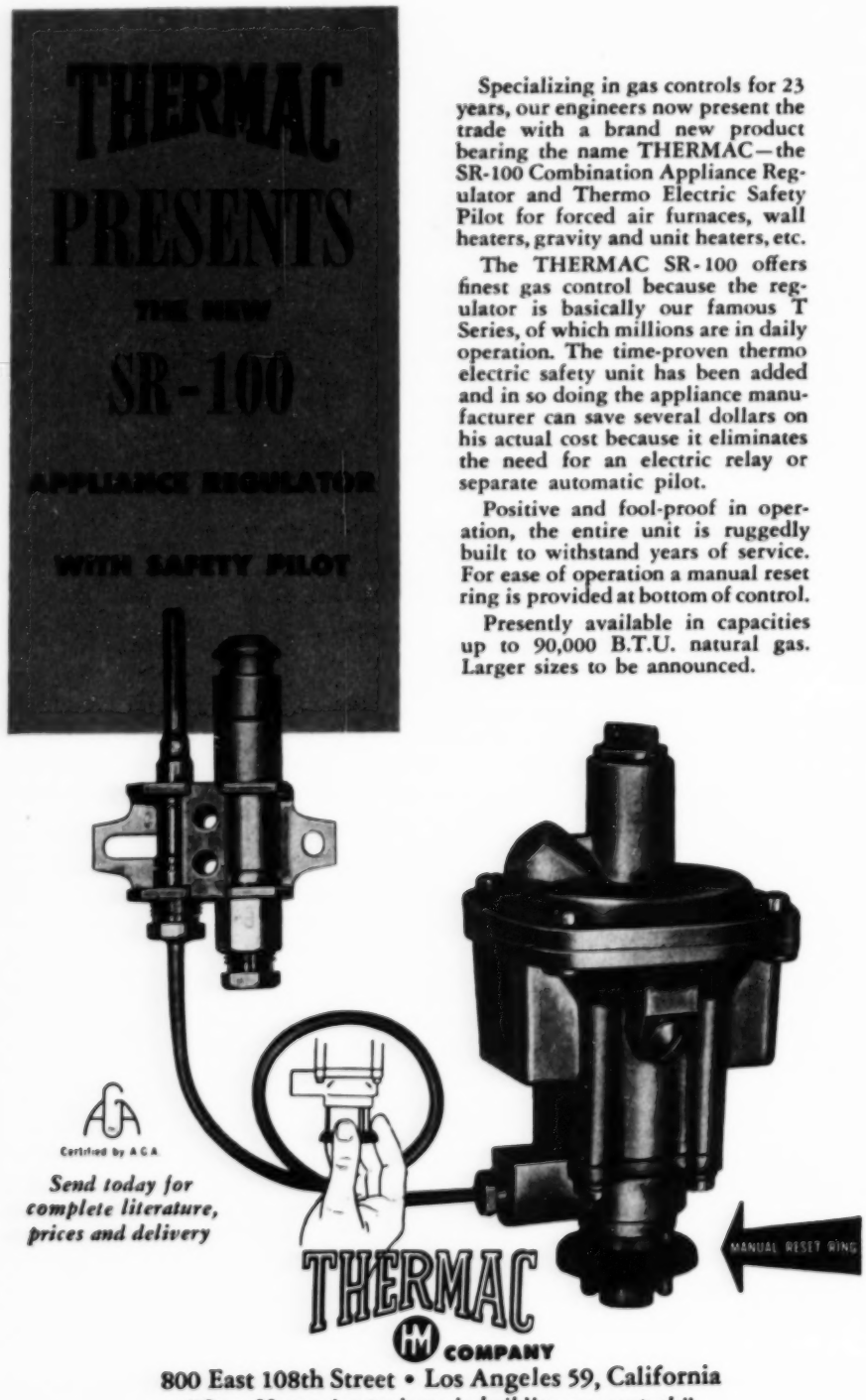
The crews will work from six mobile workshops specially designed to speed the conversion work. Each customer's appliances have already been inspected and a record made of the work needed. This record goes with the crewmen assigned a particular customer. When he does the work the crewman indicates on the card what he has done and what parts he has had to use. He tests all equipment before giving the job an okay.

Old buses converted into mobile workshops serve as a base of operations, storerooms, and as minor repair shops to speed conversion. Interiors were ripped out and adapted in the ConEd shops.

Peoples Gas continuing tests of Herscher project

Engineers of Peoples Gas Light & Coke Co., Chicago, have finished testing the Herscher storage project with radioactive isotopes in an effort to find a possible leak in one or more of the casing shoes situated at the bottom of the withdrawal and input wells. The tests did not reveal the existence of such a leak, thus checking off another possible solution to the problem.

There remain two major testing programs. Both are now under way. The first is the use of so-called bulk tracers, which involves the use of gases differing in chemical composition from naural gas and which will not lose their identities when injected into the reservoir sand. Substantial quantities of such gases will be injected from time to time in each of the 21 withdrawal and injection wells. It is believed that these bulk tracer gases will eventually put in an appearance at one or more of the vent wells which are now passing the escaping gas safely to the atmopshere. Where the leaking gas comes from and how long it takes to



Specializing in gas controls for 23 years, our engineers now present the trade with a brand new product bearing the name THERMAC—the SR-100 Combination Appliance Regulator and Thermo Electric Safety Pilot for forced air furnaces, wall heaters, gravity and unit heaters, etc.

The THERMAC SR-100 offers finest gas control because the regulator is basically our famous T Series, of which millions are in daily operation. The time-proven thermo electric safety unit has been added and in so doing the appliance manufacturer can save several dollars on his actual cost because it eliminates the need for an electric relay or separate automatic pilot.

Positive and fool-proof in operation, the entire unit is ruggedly built to withstand years of service. For ease of operation a manual reset ring is provided at bottom of control.

Presently available in capacities up to 90,000 B.T.U. natural gas. Larger sizes to be announced.

Certified by A.G.A.

Send today for complete literature, prices and delivery

THERMAC
COMPANY

800 East 108th Street • Los Angeles 59, California

"Over 23 years' experience in building gas controls"

produce it from the reservoir will be learned when the bulk tracer shows.

Another series of tests involves the use of a thermal device developed by the Peoples research group. The device will create and measure unusual temperature conditions in the wells. The temperatures will necessarily be influenced by any gas that may be escaping behind a well casing. By noting variations from normal, engineers should be able to find out if and where any such gas is so escaping.

Despite the leakage, Herscher is operating effectively and with high deliverability. Reports have been made to the effect that the reservoir is capable of delivering almost twice as much gas from a given number of wells and in a given length of time as was originally estimated.

The company has been advised that the escaping gas can be readily gathered through the vent wells and other similar points of exit, passed through the compressor station, and returned to the storage sand 1750 ft below the surface of the ground, and it is proceeding with the design and development of such a gathering system.

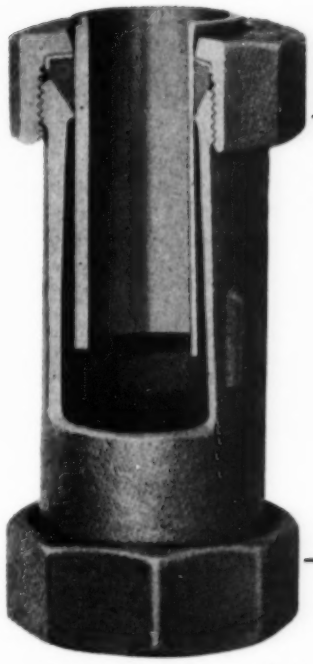
Gas sales to be one-third higher in 1957

Sales of gas by utilities and pipelines in 1957 will aggregate 74.3 billion therms, an increase of 31.5% over actual sales of 56.5 billion therms in 1953, according to a report on gas requirements and supplies just published by the American Gas Association. Supplies of gas from existing and planned facilities to meet these increased requirements will total 81.6 billion therms, an advance of 20.7% over total supply of 67.6 billion therms available last year.

To meet increased demands for serivce, the gas industry will require 4.6 million tons of steel pipe during the 1954-1957 period inclusive. Of this amount 2.9 million tons will be in the form of 16-in. diameter and over, primarily used for gas transmission lines. An additional 134,000 tons of steel in other forms and 446,000 tons of cast iron will be required.

Anticipated residential space heating requirements in 1957 will exceed those experienced in 1953 by 53% and will represent nearly one-fourth of total annual demand of all customers of the industry in 1957. Residential space heating customers will aggregate 16.9 million in 1957, equivalent to a gain of 32% over the total of households heated with gas at the end of 1953. Peak day requirements for residential space heating are expected to increase 44% during the four years, to total more than 214 million therms during the 1957-1958 heating season.

Residential base load consumption on an annual basis is expected to increase 20% between 1953 and 1957, while commercial and firm industrial consumption will advance 29% and 27% respectively. The growth of the latter two categories may be



NORMAC

Couplings, Sleeves and Fittings

for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

influenced to some extent by a more substantial growth in heating requirements.

On an annual basis, firm industrial sales will account for 45% of total industry sales in 1957 but will contribute only 24% of the peak day requirements during the 1957-58 heating season. Residential heating requirements will account for only 29% of total annual requirements during the last year of the forecast, but will represent 55% of the peak day needs.

Sales of gas to interruptible customers are expected to increase slightly during 1955 and then level off between 16 and 16½ billion therms annually. This absence is explained by the ever-increasing utilization of underground storage facilities for meeting peak day-demands imposed by househeating requirements. Increasing quantities of surplus summer gas will be injected into underground storage for subsequent withdrawal, instead of being sold to interruptible users.

It is estimated that $114 million will be expended during the next four years on underground storage projects. Anticipated withdrawals during 1957 will aggregate 4.9 billion therms while on the 1957-58 peak day the expected underground storage withdrawals of 102 million therms will represent one-fourth of the total available supply of gas from all sources for the entire industry.

The greatest relative post-war increases in demand and in customer acceptance of gas househeating have occurred in northern areas. This reflects the tremendous pipeline expansion program making more gas available to the metropolitan centers of the north. Also reflected are the high heating saturation, which has historically existed in the southern part of the country, and greater consumption requirements per customer in northern localities.

The newly opened Hartford (Conn.) Statler hotel uses gas in all of its kitchens, as do other Statlers throughout the country. The main kitchen, pictured above, features hot-top Garland ranges, fry-tops and broilers, salamander broilers, Pitco fryers, and Decks roast ovens. The breakfast kitchen has a Garland salamander broiler and a Savory toaster. In the bakeshop are six gas ovens and one Vulcan baker's oven.

Estimate $1363 million cut by new tax code

The sweeping new tax code is estimated to have cut $1363 million from business and personal taxes this fiscal year. Perhaps twice that sum will be saved in future years.

Though in general the new tax law is much more liberal toward business than the old one, some loopholes have been plugged and some provisions bear down a little harder.

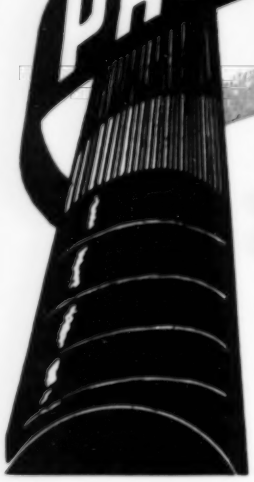
Seven main areas can be spot-lighted:

Insist on...

PROTECTO WRAP

Cold Coating

FOR COATING AND WRAPPING UNDERGROUND OIL AND GAS PIPELINES-

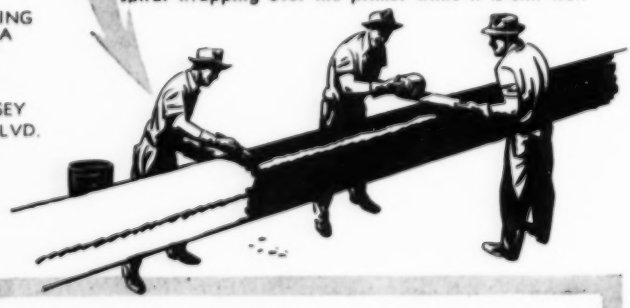


Protecto Wrap Cold Coating provides hot applied enamel quality of material and workmanship on oil and gas pipelines. It is particularly recommended for reconditioning, and for field joints and repairs to coating.

Protecto Wrap Cold Coating is applied in two steps with the following described materials — either asphalt or cold tar base depending upon adjacent coatings.

1. Protecto Wrap Cold Coating Primer consists of a heavy bodied bituminous coating that is applied by conventional brushing. Care should be taken to thoroughly fill all pits on reconditioned pipe with primer.

2. Protecto Wrap Cold Coating consists of a woven glass textile cloth saturated with asphalt or coal tar pipeline enamel. This coating is applied by spiral wrapping over the primer while it is still wet.



Our sales representatives are available to demonstrate this material and method. Address orders or inquiries to our nearest sales office or to 2255 South Delaware St., Denver, Colorado.

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PROTECTO WRAP COMPANY
DENVER, COLORADO

1. Depreciation write-off is greatly speeded.

2. Research and development costs may now be deducted in the year they are incurred.

3. Tax accounting under the law has been brought more nearly into line with generally accepted accounting principles.

4. Partnerships and proprietorships now may, under certain circumstances, elect to report and be taxed as corporations.

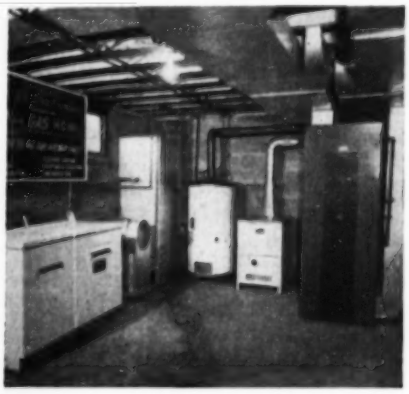
5. Retention of earnings for future expansion or modernization is made easier by the granting of a $60,000 accumulation-credit (total for all years).

6. Those with an anticipated tax liability of $100,000 or more must make their tax payments earlier in the year.

7. The new law provides for a carry-back for two years instead of one, in addition to the five-year carry forward.

Pittsburgh companies boost gas together

Three Pittsburgh (Pa.) gas companies—Equitable, Manufacturers Light & Heat, and Peoples Natural—have set out to prove that unselfish cooperation will sell gas appliances and increase the use of gas, summer and winter.

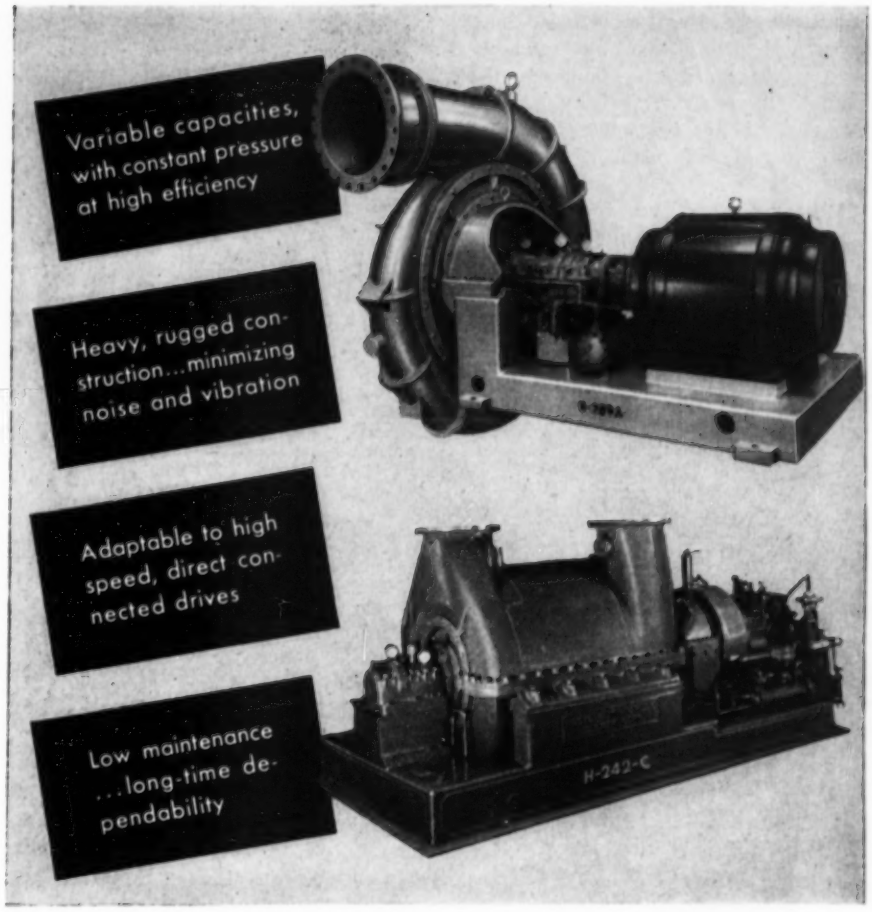


Gas parade in basement of display home shows gas dryer with twin washer, water tower for air conditioning system, water heater, incinerator, and air conditioner.

The three companies, banded together as the Natural Gas Companies of the Greater Pittsburgh Area, this year wrapped up a product and promotional all-gas package that clearly dominated the annual home display project. Of the 25 members of the Home Builders Association of Metropolitan Pittsburgh who entered the national event locally, 14 employed all seven uses of gas in their homes.

Even though all the display houses are on the lines of only one of the gas companies, it is felt that all three companies benefit equally from such "living show rooms."

Each company contributes to a fund for


Variable capacities, with constant pressure at high efficiency
Heavy, rugged construction...minimizing noise and vibration
Adaptable to high speed, direct connected drives
Low maintenance ...long-time dependability

LOOK FOR THE "BIG 4"

WHEN YOU BUY CENTRIFUGALS

Your specific needs may dictate other important characteristics in centrifugal blowers or exhausters. But even so, these four values are essential to over-all successful performance. You'll find them in every Roots-Connersville Centrifugal Unit, regardless of size. And if you desire variations to suit your application, the ability to meet these needs is a heritage of our 100 years' specializing in equipment to handle gas and air.

You'll find first-cost economies, too, in the wide range of capacities of R-C Centrifugals. From 2,000 cfm to 100,000 cfm, you can choose the single-stage or multi-stage unit most closely matched to your individual requirements. You can count on the same high quality of performance that has made many thousands of first-time buyers enthusiastic, repeat customers for R-C equipment.

For your present or future requirements, we suggest you call on Roots-Connersville, for 100 years the specialists in handling gas and air.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.
354 Oregon Ave. · Connersville, Indiana

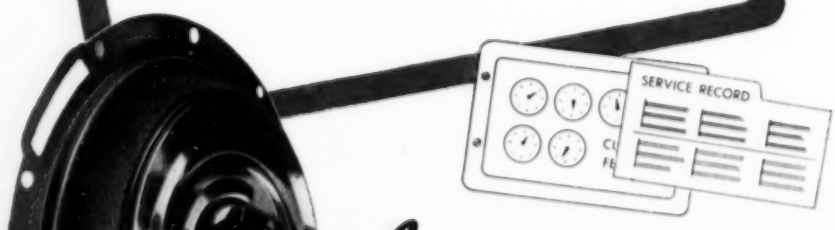
Specialists in handling gas and air

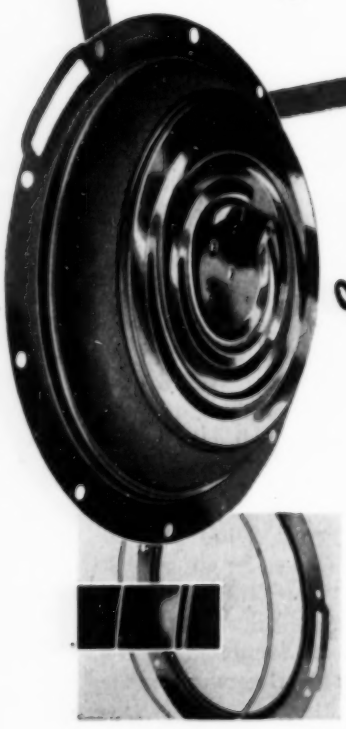
common-ground advertising. General sales managers of the gas companies form the senior committee, which administers the group. A subcommittee, the home builders committee, handles the joint promotions such as the current participation in the Parade of Homes.

Promotionally, the package contained an aggressive advertising, pamphlet and publicity campaign and the free services of local interior decorators. The utilities glamorized the offering with gas-fired Servel 2-and 3-ton all-year air conditioning systems. Also included on the all-gas roster were refrigerators, built-in ranges, water heaters, incinerators, dryers, and washers.

Architectural rendering shows four buildings totaling 29,050 sq ft. SoCounties new plant will be located on 8-acre site in Pomona, Calif.

Extra Margins of Profit!





Lancaster S-7 GROOVE TYPE METAL RIM DIAPHRAGM

Performance advantages of the Lancaster S-7 mean a closer to 100% overall accuracy — and an extra margin of profit. Patented Lancaster features and superior quality construction add up to more years of service in the meter — and another margin of extra profit.

If you are not using the Lancaster S-7 groove type metal rim diaphragm for your small meter repairs and replacements, write for a sample today.

Lancaster METER PARTS CO.

POST OFFICE BOX 378 • LANCASTER, OHIO

SoCounties to build new Pomona operating base

Southern Counties Gas Co., Los Angeles, will spend $533,000 on a new Pomona (Calif.) operating base to service its fast growing eastern division. Contracts have been signed and work is scheduled to begin immediately on the four-building project with date of completion tentatively set for June 1955.

The new base will have a staff of more than 120 employees and will house the distriubtion, construction, customer service, and customers departments. Buildings will include an office building, warehouse, garage, and locker building. There will be 90 parking spaces for employees and 40 spaces for service trucks.

PUCO lifts restrictions for two Ohio companies

The Ohio PUC has lifted all residential gas heating restrictions for the Toledo Edison Co. and the Bryan division of the Ohio Gas Co.

Unlimited use of gas for homes is provided in the order. The one remaining restriction is that commercial establishments using more than 1 million Btu's per hour must have standby equipment near by so they could switch to another type of fuel in case of emergency. This provision applies only to new installations.

Restrictions for the majority of the gas companies in Ohio were eliminated June 3, after the firms told the commission they expected to have sufficient gas supply for the coming winter.

The coming heating season will mark the first time in six years that Ohioans have gone through a winter without serious gas space heating limitations.

According to the information supplied by the companies, Ohio Gas will receive an

additional 1.6 MMcf of gas on a peak day and Toledo Edison will get an extra 1 MMcf of gas, both from Panhandle Eastern Pipe Line Co.

Robertshaw-Fulton opens new research center

A $1 million research center that will develop new control devices for home appliances and industry has been formally opened in Irwin, Pa. by Robertshaw-Fulton Controls Co.

Victor Weber, who is vice president and director of research and development, will make his offices at the new four-story center, which will serve as research and development headquarters for the company's seven manufacturing divisions.

The laboratory proper, one of three departments at the center, consists of a number of specialized rooms with equipment for testing at temperatures up to 800°F. One room, always open to outside temperature and atmospheric conditions, is designed for modified exposure weather testing. In the tower section of the center, a complete four-room apartment layout and also a cold test room, with walls constructed exactly like those of the average home, are available for testing controls used in various systems of househeating.

Los Angeles companies help handicapped youngsters

Thanks in part to Southern Counties and Southern California Gas Co.'s and three gas appliance manufacturers, crippled youngsters at the Los Angeles Orthopaedic hospital each day are being taught to live a life as normal as their disability permits.

The two gas companies and Servel, Whirlpool, and O'Keefe & Merritt cooperated in fully equipping a model gas kitchen with latest appliances so that handicapped teenagers—and also some grown-ups—can learn to cook and keep house.

The kitchen is part of a just-opened rehabilitation wing at the hospital, the aim of which is "to help them lead a full life despite their handicaps . . . "

The handicapped will be taught to plan meals, prepare, cook, and serve food and will have to learn to wash dishes and mop floors.

Two new editors join GAS staff

William W. Clark, editorial director of Jenkins Publications Inc., Los Angeles, has announced the addition of two editors to the GAS staff. The appointments include J. Fred Edbon as managing editor and Harold C. Hood as field editor.

Mr. Ebdon received his engineering training at the University of Texas and for the past five years has been gas distribution

This CLEVELAND

Digs 4 to 5 Jobs Every Day

This "Baby Digger" meets heavy daily schedules of scattered jobs, digs *on time, every time,* hustles safely from job to job at legal limit speeds on a compact Cleveland trailer.

This CLEVELAND

Lays Pipe, Fills Trench, Tamps Fill

The Cleveland "80" (or "80-W")—widely employed in gas distribution construction—saves *money, men and machines.* One-man-operated, it does a faster, safer, cleaner job on *each* of these construction operations.

Write for descriptive bulletins and specifications, or get the full story on CLEVELANDS from your local distributor

THE CLEVELAND TRENCHER COMPANY
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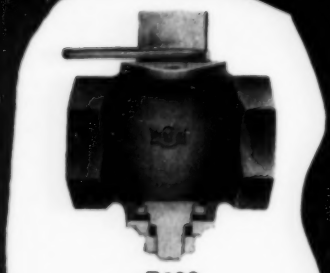
CLEVELAND

IT PAYS TO BUY HAYS that are TOPS

7405
Iron Body, Galvanized,
Bronze Plug Stop



7490
"Key-Lok" Tamper Proof Stop
Lockwing—Iron Body,
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7500
Threadless Gas Stop
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Service Line Stops—Meter Stops
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Tamper Proof and Standard Patterns

Iron Body with Brass Plug
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Full Range of Sizes

Quality Assured . . .
By Precision Machining—
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for Over 80 Years

Standard Packaging for Easy Handling,
Space Saving Storage . . . Another HAYS First

Write for literature, or ask "The Man from Hays"

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HAYS MANUFACTURING CO.
ERIE, PA.

engineer for United Gas Corp., Houston. He edited and published the employee training material used by this company.

Mr. Hood graduated from Carnegie Tech, major in engineering, and was formerly in the editorial department of Steel Publications Inc., Pittsburgh.

Frank Chapman continues as editor of GAS, now in its 31st year of publication. Mr. Chapman received his training at Georgia Tech and had a sound publishing background through various NEA-United Press associations before joining GAS.

LPG equipment appears in civil defense exhibit.

Well known makes of L.P. gas tanks, regulators, valves and fittings were an important feature of the government-sponsored improvised hospital exhibit set up at the recent American Hospital Association convention at Chicago's Navy Pier. During the four-day show visitors saw how the Federal Civil Defense Administration, by using quickly and readily available L. P. gas, would meet the need for restoring cooking and sterilizing facilities destroyed by all-out bombing attacks or similar catastrophies falling on American metropolitan areas.

The first assembled unit of the FCDA's improvised hospital program is a 200-bed package that can quickly be set up in any suitable building such as a school or church and provide complete hospital facilities including surgery. Tacit testimonial as to FCDA's belief in the advantage of LPG in a large scale emergency is its use of that fuel to operate cooking and sterilizing equipment.

The improvised hospital, one of more than 300 already on order by the FCDA, is slated to be widely used as a civil defense training aid. The Chicago LP-Gas Committee, headed by Col. E. L. Mills, Bastian-Blessing Co., arranged the showing of the equipment.

AGA and EEI complete customers relations kit

AGA and the Edison Electric Institute have just completed a customer relations training package that is based on the premise that utility companies require an educational course in customer relations that has been tailored to the problems of their own industry.

A major component of the package is a manual of customer relations principles to serve as a guide for supervisors who train employees in various types of customer contact jobs.

Also included in the kit are five sound-slide films, each with a trailer suggesting questions for later discussion. Follow-up booklets on each of the five subjects covered by the manual and the slide films are included.

News Notes

The composite price of 30 natural gas company common stocks on Sept. 24, 1954, was 25.2% higher than on the comparable date one year earlier, the AGA reports. Accompanying this significant increase in the price for these securities was a moderate increase of 6.1% in dividend payments. As a result, these stocks experienced a decline of 15.3% for yields when compared to the similar period one year prior. The yield on the 30 natural gas common stocks was 4.75% in the current period.

Total sales of gas to ultimate consumers of the gas utility and pipeline industry during August amounted to 3864 million therms, equal to an increase of 6.5% over total sales of 3628 million therms in August of last year, representing an all-time high in gas for the month. Steady gains in the number of new customers and greater consumption per customer accounted for the rise in gas sales.

The United Gas, Coke & Chemical Workers (CIO) have approved a proposed merger with the Oil Workers International in a move to form a 180,000-member union.

Prat-Daniel Corp., South Norwalk, Conn., has acquired the patents, sales, and manufacturing rights of Overhead Panelray, a gas-fired infra-red industrial and commercial heating device which has been developed and sold during the past six years by the Day & Night division of Affiliated Gas Equipment Inc., Monrovia, Calif.

Cast Iron Pressure Pipe Institute is now located in new offices in the Pennsylvania Bldg., 425 - 13th St. N.W., Washington 4, D. C., according to an announcement by Sidney E. Linderman, executive vice chairman.

Stabar Distributing Inc., Jersey City, has been appointed distributor for Servel gas and electric appliances. The territory served by the company includes 13 counties in northern New Jersey, and Rockland county and Richmond borough in New York.

Two McIlroy fluid network analyzers have been installed recently. The device, which is set up to simulate the gas system, has been installed by New Orleans (La.) Public Service Inc. and the Pittsburgh Group of the Columbia Gas System.

Pennsylvan's supreme court has declared that Greene county common pleas court has jurisdiction to rule on an attempt by coal companies to halt underground gas storage in Greene county's Pratt pool. Several companies filed suit against Equitable Gas Co. asking the lower court to order the firm to stop the underground storage of gas. Equitable appealed to the higher court, claiming that the FPC and the state PUC had jurisdiction, not the Greene county courts. However, the state supreme court ruled that the lower court has the right to hear and decide the case.

Aiming to double its number of services quickly when natural gas from Alberta is available at the end of 1955, the Winnipeg & Central Gas Co. has started construction of seven miles of mains to service two private housing developments on the outer fringes of the city.

To meet present and future peak gas demands during winter months, the Richmond (Va.) Department of Public Utilities will install two Koppers-Hasche reformers to supplement its present gas facilities. When completed, the two units, to be installed by the chemical and gas department, engineering and construction division of Koppers Co. Inc., will have a combined capacity of 5 MMcf of gas per day.

Final approval has been received to change the name of the Pittsfield Coal Gas Co. to the Berkshire Gas Co. The Berkshire Gas Co., serving approximately 24,000 customers, is the result of the recent merger of Berkshire Gas Co. of North Adams into Pittsfield Coal Gas Co.

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ASSOCIATIONS

Accidents cost economy $9 billion in 1953

Although the death rate from accidents in 1953 was 60 per 100,000—the lowest on record —there was a toll in the United States of 95,000 lives lost and 9.6 million injuries. These figures were brought to light by Earl Eacker, outgoing AGA president and president of Boston Consolidated Gas Co., at the recent conference of the AGA accident prevention committee in Hartford, Conn.

Mr. Eacker went on to point out that traffic accidents alone killed 38,300 persons last year— one and a half times the number of persons who died in the Korean War. The time lost last year by workers of all kind was equivalent to an entire year's shutdown of industrial plants employing 1.9 million men and women, he said; or, in other words, removing from production all of the plants of General Motors, Ford Chrysler and U. S. Steel. Or, to compare with the gas industry, the loss of the entire gas industry if it employed seven times as many people as it does today.

"It is estimated that the 1953 accidents cost our economy more than $9 billion, nearly a quarter of our budget for national defense," he said. " . . . $1 million is a stack of new one thousand dollar bills 8 in. high. . . . To provide ($1 billion) in new one thousand dollar bills, the stack would be piled as high as the Washington Monument and would reach into the sky for a hundred more feet."

Twenty-eight Southern Gas Association men attended the recent western area distribution operating problems round-table conference in Houston. E. S. George (standing, center), Houston Natural Gas Corp., sponsored the conference at which discussion centered around gas mains, meters, safety, maps, appliance service, plastic pipe, and radio dispatching.

Time extended for entries in GAMA's PEP contest

GAMA's PEP prize contest rules have been amended so that all participants in the competition for cash prizes have until Dec. 30 to report on commercial gas appliance sales made between Sept. 1 and Nov. 30 and installed prior to Dec. 20. This is the only change, which has been made to give companies an extra 10 days to compile sales figures.

Companies who are competing for the three $300 prizes that GAMA is going to pay sales leaders in the campaign include: Alabama Gas Corp., Binghamton Gas Works, Bridgeport Gas Light Co., Cumber-

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land & Allegheny Gas Co.; Gas Light Co. of Columbus (Ga.), Harrisburg Gas Div., Keystone Gas Co., Laclede Gas Co., Lancaster (Pa.) County Gas Div., Lawrence (Mass.) Gas Co., Lehigh Valley Gas Div., Manufacturers Light & Heat Co.; Michigan Consolidated Gas Co., Minneapolis Gas Co., Mystic Valley Gas Co.; Northhampton Gas Light Co., Ohio Fuel Gas Co., Philadelphia Gas Works Div., Piedmont Natural Gas Co., Southern California and Southern Counties Gas Co.'s, South Jersey Gas Co., Washington Gas Light Co., and Reading Gas Co.

E. R. Griffith joins AGA staff as research engineer

E. R. Griffith

E. Russell Griffith, formerly associated with the gas department of Ford, Bacon and Davis Inc., has joined the American Gas Association as reasearch engineer. He will assist T. L. Robey, coordinator of research under the gas industry's par plan. Mr. Griffiith will be employed primarily on pipeline research work.

At Ford, Bacon and Davis, Mr. Griffith worked on gas field reserves and deliverability studies, natural gasoline plants, natural gas pipeline design and related economic studies, compressor stations, petroleum products pipelines and chemical design.

Speakers bureau formed by conversion burner group

The newly formed conversion burner division of GAMA has established a free speaker's bureau to meet the demand from builders, dealers, and utilities for the latest information on developments in this fast-growing househeating field.

Harry C. Gurney of Surface Combustion Corp., chairman of the division, said that as a result of requests for information about conversion burners that have come into GAMA headquarters, 17 engineering, sales and service experts from 10 different companies have volunteered their services as speakers.

Pipeline problems to be discussed at NACE meet

Eleven symposia are to be held during the 11th annual conference and exhibition of the National Association of Corrosion Engineers March 7-11, 1955 in Chicago. Also scheduled are a panel discussion on pipelines, a pipline problem clinic and an un-

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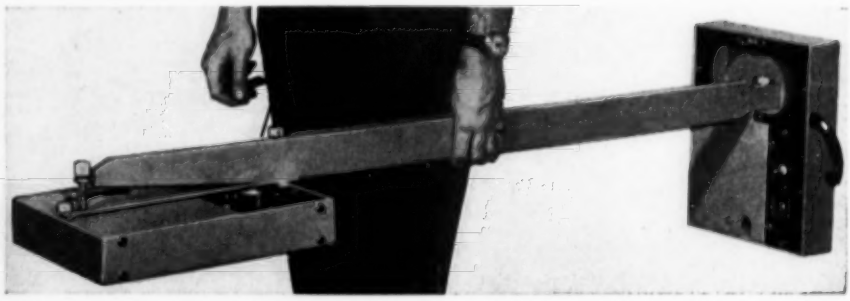

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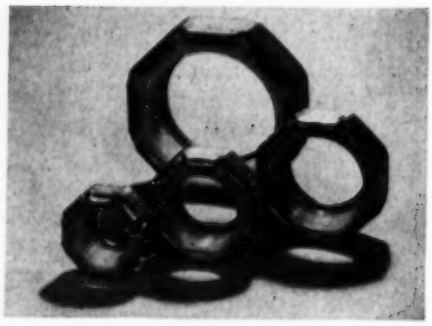

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derground corrosion roundtable; a general corrosion problems roundtable, three educational lectures and numerous technical committee meetings. First day of the conference will be devoted wholly to committee meetings.

The chemical industry and petroleum production metallurgy symposia each will be divided into two sessions.

The annual business meeting of NACE, according to custom, will be the opening event of Tuesday, March 8. The technical events start when the business meeting ends and continue through noon, Friday, March 11.

All meetings as well as the corrosion exhibition will be at the headquarters hotel, the Palmer House.

AGA issues how-to-do-it booklet on PR subjects

How to take the public behind the scenes and show them the inside story of the gas business is outlined in "Open House," new 16-page illustrated booklet produced by the AGA.

This is the first in a series of how-to-do-it booklets that AGA is preparing on public relations subjects of basis interest to member gas companies. Each booklet in the overall series will be designed to help stimulate stronger gas industry public relations efforts at the local level.

Material and suggestions for the plant tour booklet were collected from gas companies throughout the country. Five brief case histories show what local companies are doing to win community friends through plant tour programs.

Association notes

C. L. C. Kah, Florida Public Utilities Co., West Palm Beach, has been elected chairman of the Florida-Georgia Gas Association, filling the remainder of the term of Roy Jones, who has resigned. Joseph Frink, Florida Power & Light Co., Miami, remains as secretary-treasurer.

The next International Petroleum Exposition of Tulsa will probably be held in 1957 or 1958, according to William B. Way, general manager. The Tulsa show is in no way connected with the International Oil Exposition, which is scheduled for Houston in 1955.

Plans are being made for the initial meeting of the general management section of the AGA, which will meet for its first annual spring conference early next year. Howard B. Noyes, vice president of Washington (D. C.) Gas Light Co. and chairman of the section, has announced that W. B. Tippy, vice president of Commonwealth Services Inc., New York, will serve as chairman of the arrangements committee.

ABSTRACTS

DESIGNS OF PIPELINES FOR THE SIMULTANEOUS FLOW OF OIL AND GAS—By Ovid Baker, Magnolia Petroleum Co., Dallas. Presented at the annual NGAA convention in Dallas, April 21-23.

Measurements were made of pressure drops for oil and gas flowing simultaneously through 4- to 10-in. diameter pipelines. These results were correlated with data from the literature for ½ to 3-in. diameter pipelines. Previously published data were used to construct a generalized chart for predicting the type of flow pattern in the pipeline. The flow patterns described are bubble flow, plug flow, stratified flow, wavy flow, slug flow, annular flow, and spray flow. The experimetal data were shown to be consistant with the generalized flow pattern chart.

The calculation method proposed by Lockhart and Martinelli for designing two phase pipelines was shown to be inadequate for larger diameter lines and also for some flow patterns. Modifications of the above method in the form of separate equations for each type of flow pattern are presented.

CONTINUOUS DETERMINATION OF SUSPENDED SOLIDS IN FUEL GAS AS AN AID IN CONTROL OF PRODUCTION EQUIPMENT—By Robert W. Gilkinson, Rochester (N.Y.) Gas & Electric Corp. Presented at the AGA chemical, engineering and manufacturing conference, held in Pittsburgh, May 24-26.

An automatic lampblack sampler, indicator, and recorder has been developed in Rochester's chemistry laboratory which is based upon the principle of filtering continuously out of a gas stream any lampblack in suspended form and making measurements of the quantity of lampblack by photo-electric means. This instrument incorporates the use of a Research Appliance Co. smoke sampler, a Welch Densichron Densitometer, a Sola constant voltage transformer, and a Minneapolis-Honeywell ElectroniK circular chart recorder. Many changes were made to the special sampler to answer the company's particular problem. Trial runs over eight and 24-hour periods have indicated that this instrument is of great value in indicating the condition of the CCR production gas relative to the presence of any amounts of lampblack.

The circular chart recorder provides a permanent record of the lampblack condition of the gas at all times. An alarm switch tied in with a signal light makes contact when lampblack readings of a predetermined amount are reached and recorded on the chart of the instrument. At this same time, an electrical connection made with the sample unit proper automatically resets it to a new filter paper spot and thus a new test is started. This materially aids the operator in determining whether he has made adequate adjustments to the particular CCR unit.

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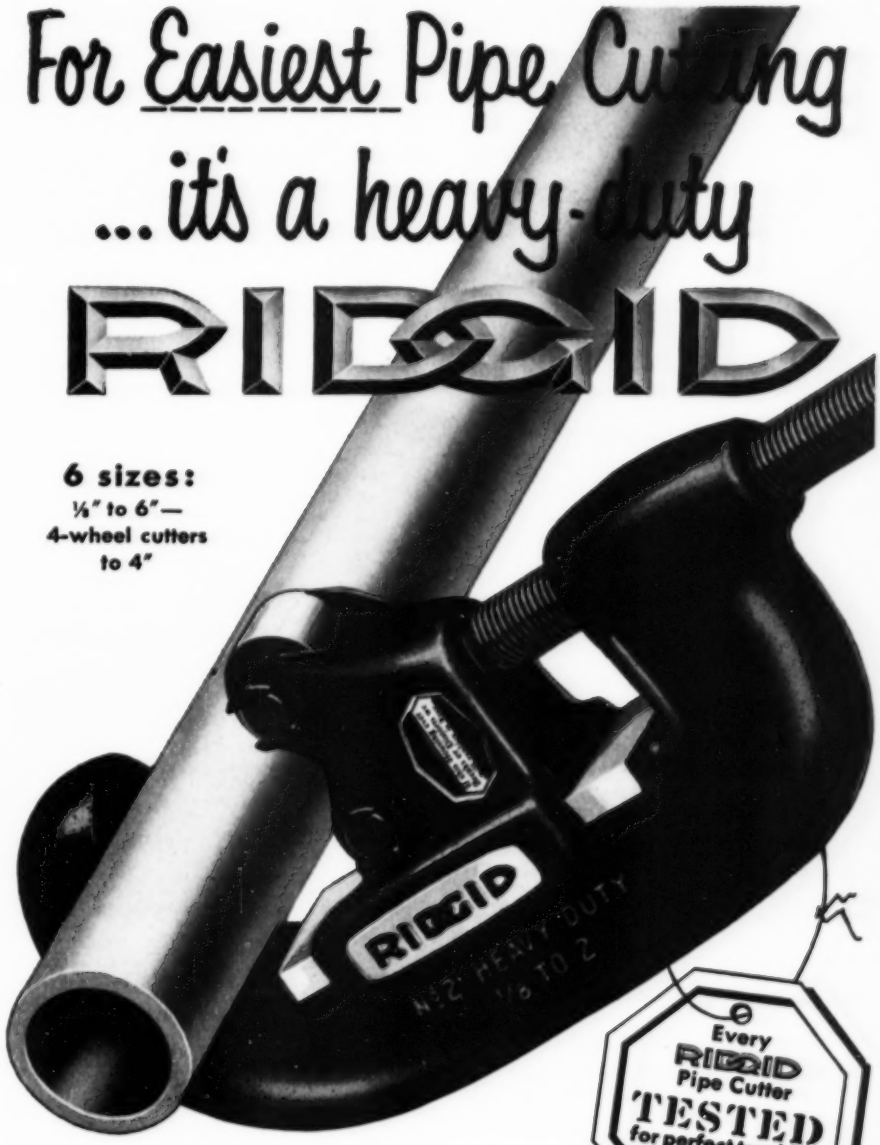

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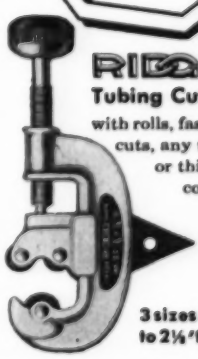

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ATlantic 1-6970

This new sampler and recorder has been in almost continuous operation now for about four months on Rochester's CCR gas. It has provided a positive indication at all times of the nature of the sendout gas with regard to the presence of any suspended lampblack. The company has been able to control its operations so that lampblack formation has been kept to an absolute minimum. In fact, most of the time the sendout gas is free and clear of any of these suspended particles.

A STUDY OF WEAR AND SERVICE PERFORMANCE OF GEARS SURFACE HARDENED BY INDUCTION HEATING AND BY HIGH-SPEED DIRECT-GAS HEATING—Research Report of studies conducted at Battelle Memorial Institute under the AGA's industrial and commercial gas research project I G-4.

This report describes simulated-service tests of spur gears (of SAE 1045 steel) surfaced hardened by induction heating and surface hardened by high-speed direct-gas heating.

Gears were tested at two values of pitch-line load in a "four-square" dynamometer. Pitting of teeth was chosen as a criterion of failure, and lifetimes to such failure were observed. Additional studies included metallographic examination of the hardened structure and examination for possible distortion in hardening.

Differences in the hardened structure were apparent; some of the differences were in excess of those expected in production, on account of excessive heating times and quenching conditions used in the gas tests. Despite these differences, there was no significant difference in observed lifetimes in the simulated-service tests.

The results of the investigation of a limited number of spur gears, hardened by each of the two methods, were as follows:

(1) Neither distortion nor appreciable decarburization was evident in gears hardened by either method.

(2) Some differences in metallurgical structure and hardness gradient were observed; these differences were somewhat larger than might be expected in optimum-production practice, on account of recognized limitations in the test setup for gas hardening.

(3) Despite these differences, gear performances in the simulated-service tests were essentially the same.

The important conclusion implied by these observations is that resistance to surface pitting of teeth was about the same for gears hardened by the two methods of heating.

This investigation and the earlier study have provided some information for technical appraisal of the two methods of surface hardening. This information suggests that either method can provide a surface equally resistant to failure by fatigue cracking or to surface pitting such as occurs in gear teeth.

People

Promotions

Sharples Chemicals Inc., Philadelphia, has announced the transfer of JOHN W. CONYERS JR. from the sales department to the market development department; the appointment of JOHN R. PFANN as sales analyst; and MELBOURNE P. BINN to the post of senior salesman for the St. Louis, Mo. territory.

VICTOR V. MYERS JR. has been named field engineer in charge of the newly formed Albuquerque (N. M.) district office of CEC Instruments Inc., sales and service subsidiary of Consolidated Engineering Corp., Pasadena, Calif.

CHARLES G. BARNDT, superintendent of Lone Star Gas Co.'s Oklahoma distribution properties for six years, has been appointed to the newly created post of director of sales and promotion for the company. GEORGE F. PECK succeeds him in the Oklahoma position.

T. Benjamin

J. A. Wolff

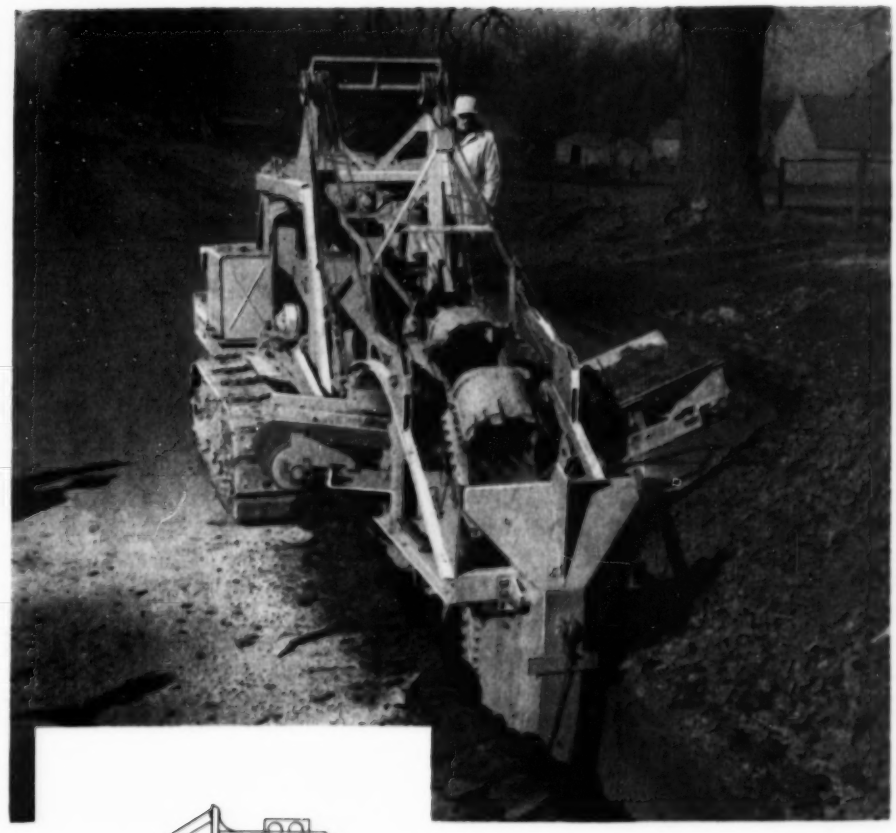
General Controls

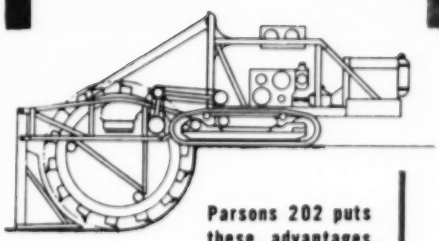
THAER BENJAMIN has been promoted from the Los Angeles city sales office of General Controls Co. to the post of manager of the company's branch office in Salt Lake City, covering the states of Utah, Idaho, and Montana. The company has also announced that JOHN A. WOLFF has joined the company as heating controls division sales manager.

WILLIAM C. BEATTIE has been appointed manager of Consolidated Edison Co.'s production department, succeeding JEFFERSON C. FALKNER, who retired Oct. 1.

WILLIAM W. WALLACE, general manager of the international division of Servel Inc., Evansville, Ind., has also been made assistant vice president.

Five regional sales managers have been appointed by Glass Fibers Inc., Toledo. They are AUSTIN MARQUIS, Detroit; EDWARD A. McCabe, New York; JOHN B. BANKS, Philadelphia, ROBERT E. SIMPSON, Atlanta; and KEN C. SETTELMYER, Chicago.





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Digs 6 FEET deep 13 to 31 in. wide

When your work schedule calls for additional gas transmission and distribution lines, it will pay you to look into the big work capacity of this Parsons 202 wheel-type Trenchliner. Its multiple operating speeds give maximum digging efficiency at every width, depth, and in all soil conditions. Specified grades are easy to maintain, because digging wheel responds instantly to sensitive friction-clutch control. Arched wheel frame, rigidly trussed, and three double-wheeled guide rollers keep digging wheel precision aligned. Let your Parsons distributor tell you more about this 202 utility Trenchliner. He can also show you 4 other sizes of wheel and ladder-type machines on crawlers . . . and a small rubber-tired Trenchmobile®.

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Arizona Public Service

Newly elected officers of Arizona Public Service Co., Phoenix are DON WILLIS, vice president in charge of sales: WALTER T. LUCKING, vice president in charge of operations; and T. A. PHILLIPS, vice president in charge of engineering. GEORGE H. GROH moves up from vice president in charge of operations to vice president and assistant to the executive vice president in charge of planning and production. DOUGLAS B. MCGREGOR becomes vice president in charge of personnel and CLARE TITUS is now assistant to the president and general manager.

GEORGE R. WOEHLER, former secretary, has been elected vice president and comptroller of Southern Indiana Gas & Eectric Co., succeeding CHARLES E. OSWALD, who retired last month. Mr. Oswald will continue on the board of directors.

INWOOD SMITH, formerly vice president in charge of sales, has been named vice president of the newly created marketing department of RCA Estate Appliance Corp. Hamilton, Ohio. GORDON P. HENTZ becomes manager of product planning; THOMAS F. BARTLEY, merchandise manager of sales administration. The company has also announced the appointment of JACK BAGLEY as district manager in the Cleveland area and LEE FAUST in the Cincinnati area.

NEIL BOYLE is now sales manager of the Metal Fabricating Co., a division of the Detroit-Michigan Stove Co.

H. J. HOWERTH has been promoted to product sales manager for Gar Wood truck winches and cranes.

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T. A. Phillips **Clare Titus**
Arizona Public Service

PAUL A. BARKMEIER, until recently vice president of distribution, has succeeded to the presidency of RCA Estate Appliance Corp., filling the vacancy resulting from the resignation of CECIL M. DUNN.

EDWARD F. BROWN has been promoted to the post of sales engineer for Peerless Manufacturing Co. and its subsidiary, Sillers Engineering Co. He will handle sales activities in the north Texas area.

ELLO E. RICHARDSON has been promoted from general superintendent to assistant general manager of the Cambridge (Mass.) Gas Light Co.

Affiliated Gas Equipment Inc. has named KEITH T. DAVIS technical director. He formerly directed the engineering program of the Bryant Heater division. The company also announced that JOHN H. JENNINGS has joined Bryant as director of engineering. He was formerly with Servel Inc.

D. J. Wood **W. D. Cole**
Titan Valve Pittsburgh Group

DONALD J. WOOD, sales manager, has been elected vice president and general sales manager of the Titan Valve & Manufacturing Co., Cleveland. STERLING J. CROSS was elected treasurer.

Transfers

W. D. COLE, formerly division engineer for Gulf Interstate Gas Co., has been named assistant chief engineer of Manufacturers Light & Heat Co. and other Pittsburgh Group companies of Columbia Gas System.

PIERRE VINET, director of sales promotion of the Geo. D. Roper Corp., has resigned to become sales director of A. R

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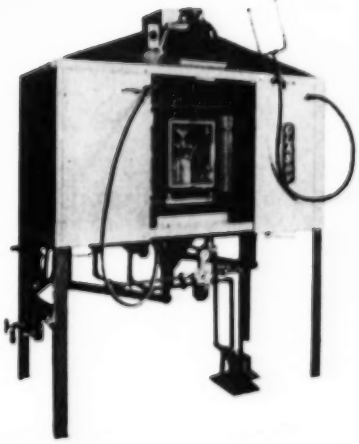
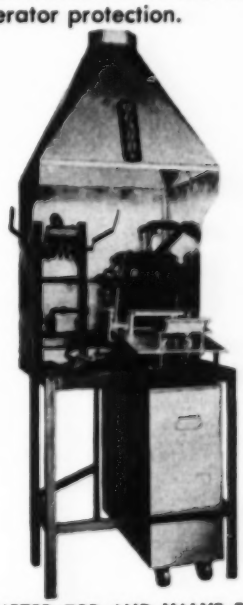


METER FRONT AND BACK REMOVING MACHINE



METER TOP AND VALVE BOX COVER REMOVING MACHINE

CALENDAR

November

1-5..National Metal Exposition—Chicago, Ill.

4..NEGA Operating Division — Hotel Statler, Hartford, Conn.

5..SGA Field Production of Natural Gas Conference—Herring Hotel, Amarillo.

8-9..Gas Measurement Institute—Legion Hall, Liberal, Kan.

8-11..American Petroleum Institute—Conrad Hilton Hotel, Chicago.

12..SGA Residential Sales Conference—DeSoto Hotel, Savannah, Ga.

15-17..American Standards Association—Hotel Roosevelt, New York.

17..NEGA Safety Conference — Hotel Statler, Boston.

17-19..Southeastern Gas Association —Sir Walter Hotel, Raleigh, N. C.

17-19..Wisconsin Utilities Association, Electric & Gas Section, Technical & Sales & Service Divisions — Hotel Schroeder, Milwaukee.

19..NEGA Industrial Group, C-H-I Division — Hampshire House, Boston.

19..SGA Residential Sales Conference — Marion Hotel, Little Rock.

28-3..American Society of Mechanical Engineers — Statler Hotel, New York.

December

3..Panhandle Plains Regional Meeting NCAA — Herring Hotel, Amarillo, Texas.

3..NEGA Gas Utility Sales Managers Conference — Hampshire House, Boston.

6-7..SGA Advisory Council and Management Conference — Point Clear, Ala.

6-8..AGA-EEI Electronics Seminar — Hotel Commodore, New York.

7..NEGA Appliance Servicing Conference — Hotel Statler, Boston.

8-10..Eastern Computers Conference (AIEE, IRE, ACM) — Bellevue-Stratford Hotel, Philadelphia.

1955

January

17-19..7th Annual Convention, Pipe Line Contractors Association —Statler Hotel, Los Angeles.

18..NEGA Operating Division—Hotel Statler, Boston.

21..SGA Employee Relations Roundtable — Nashville.

24..SGA Air Conditioning Sales Conference — Adolphus Hotel, Dallas.

24-26..AGA Home Service Workshop—Drake Hotel, Chicago.

26-28..Instrumentation for the Process Industries Symposium—Texas A&M College, College Station, Texas.

February

13-15..24th Annual Mid-Winter Conference of Public Utility Buyers' Group, National Association of Purchasing Agents — Shamrock Hotel, Houston.

March

7-9..Mid-West Gas Association—St. Paul Hotel, St. Paul, Minn.

7-11..National Association of Corrosion Engineers — Palmer House, Chicago.

24-25..NEGA Annual Meeting — Hotel Statler, Boston.

24-25..Oklahoma Utilities Association Convention — Mayo Hotel, Tulsa.

April

12-14..AGA Sales Conference on Industrial & Commercial Gas —Hotel Statler, Boston.

12-15..AGA Distribution, Motor Vehicles & Corrosion Conference — Netherland Plaza, Cincinnati.

19-21..Southwestern Gas Measurement Short Course—University of Oklahoma, Norman.

20-22..Indiana Gas Association Annual Meeting — French Lick Springs Hotel, French Lick, Ind.

25-27..National Conference of Electric and Gas Utility Accountants — Conrad Hilton Hotel, Chicago.

25-27..Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

May

9-10..AGA Gas Supply, Transmission & Storage Conference—William Penn Hotel, Pittsburgh

16-18..Southern Gas Association — New Orleans.

Wood Manufacturing Co. He will headquarter in Chicago.

WALLACE E. HERTEL, formerly chief operating engineer with the Wisconsin Southern Gas Co., has moved to Pittsfield, Mass., to serve as engineer for the Berkshire Gas Co.

New faces

ERIC RUCKELSHAUS and LEE HANOWER have joined the staff of Ebasco Services Inc., New York. Mr. Ruckelshaus will serve as a senior business consultant and Mr. Hanower as a business analyst in the petrochemical and plastics fields.

JOSEPH J. PTACIN has joined Florence Stove Co. as advertising manager. He will headquarter in Chicago.

WILLIAM F. ROONEY has been put in charge of the newly opened Portland, Ore., office of Ebasco Services Inc.

S. E. SCHULTZ has joined the staff of H. Zinder & Associates Inc. to direct the operations of the utility consultants' newly opened Pacific Northwest regional office in Seattle. Mr. Schultz until recently was chief engineer of the Bonneville Power Administration.

RICHARD B. SWEET has been appointed to the post of sales manager of the wholesale division of John J. Nesbitt Inc., Philadelphia. MICHAEL J. MURRAY, formerly head of the division, will take on the sales management of another of the company's heating and ventilating products.

WILLIAM R. PIERCE has joined the staff of the National Petroleum Association as commerce counsel, succeeding GERALD L. PHELPS, who is retiring.

RALPH C. MORLEY JR., president of Morley Brothers Hardware Co., has been elected a director of Consumers Power Co., Jackson, Mich., succeeding ROBERT M. FARR, who has resigned.

B. T. ROE, formerly vice president of the Edgewater Steel Corp., has joined the Detroit (Mich.) Brass & Malleable Co. as vice president.

Honors

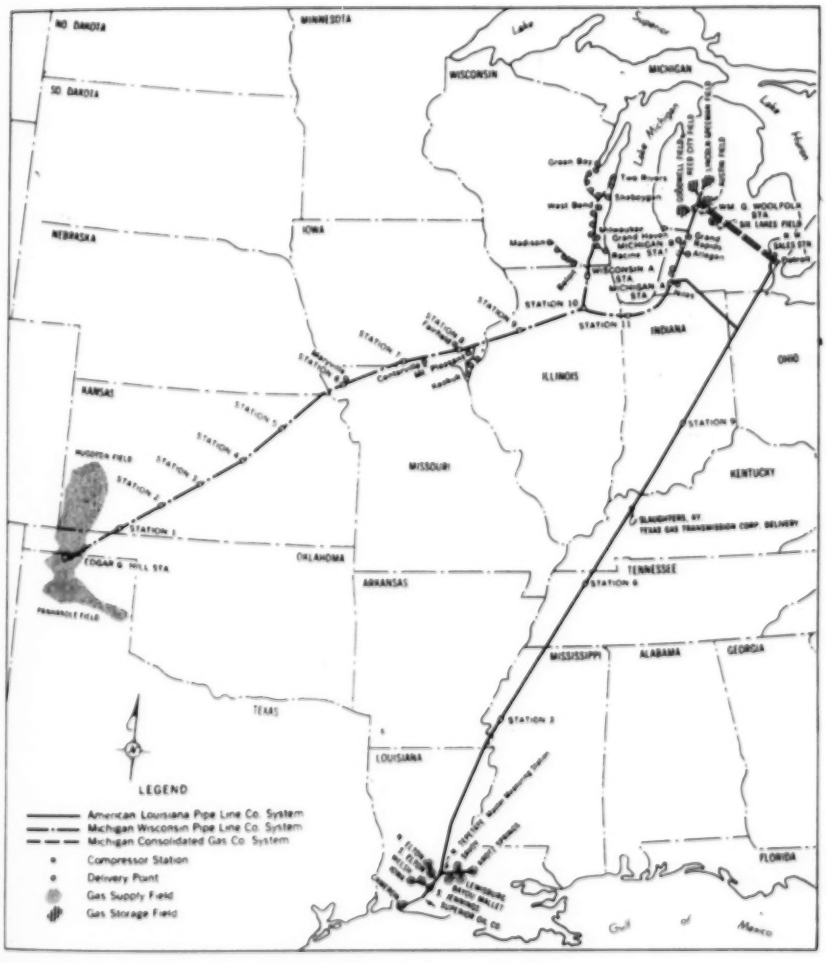
WALTER J. HERRMAN, vice president of Southern California Gas Co., has been elected to the board of directors of Junior Achievement of Los Angeles county.

ROBERT L. SINK, assistant director of engineering of Consolidated Engineering Corp., Pasadena, Calif., has been named chairman of the Institute of Radio Engineer's Professional Group on Instrumentation.

GAS

Transmission and Conditioning Section

American Louisiana wins certificate in last minute 3-2 FPC decision



The portion of the line from Payne on the western edge of Ohio to Bridgman, Mich., on the southern end of Lake Michigan, was not approved pending conclusion of the proceedings on related applications by Michigan-Wisconsin Pipe Line Co. and Michigan Consolidated Gas Co.

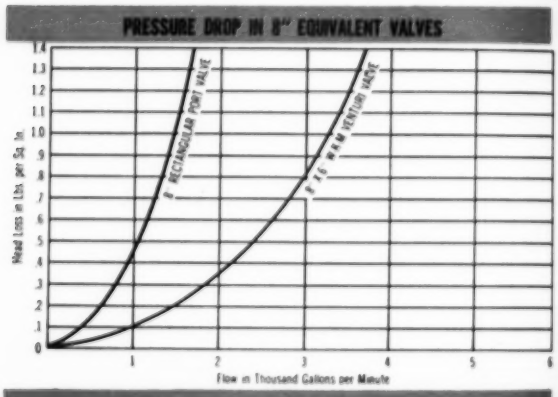
The Federal Power Commission has issued a conditional certificate to American Louisiana Pipe Line Co., Detroit, authorizing a Lousiana-to-Michigan natural gas transmission system which will serve ultimate markets in the Michigan-Wisconsin area.

But whether all the major suppliers will honor their contracts with American Lousiana, in view of the Phillips decision bringing them under FPC jurisdiction, remained unsettled. Gulf Oil and Humble both had escape clauses in their contracts, and in the dissenting opinion filed by Chairman Kuykendall and Commissioner Seaborn L. Digby it was pointed out that "two suppliers, representing about 25% of the gas American Louisiana has contracted for, have indicated clearly in petitions seeking reconsideration of our Order 174A . . . that they consider their contracts at an end."

The certificate is conditioned to provide that American Louisiana cannot commence construction until the independent producers that are to supply natural gas have applied for and obtained FPC authorization. The commission's action came on the last day before the various sellers could have exercised an option to terminate their contracts—although, as pointed out in the minority report, two might yet cancel their commitments.

Continued on page 115

AN ENGINEER LOOKS AT W-K-M VALVES ON PRESSURE DROP IN W-K-M ROUND OPENING VENTURI VALVES AND RECTANGULAR OPENING PLUG VALVES


PRESSURE DROP IN 8" EQUIVALENT VALVES
Head Loss in Lbs. per Sq. In.
8" RECTANGULAR PORT VALVE
8" W-K-M VENTURI VALVE
Flow in Thousand Gallons per Minute

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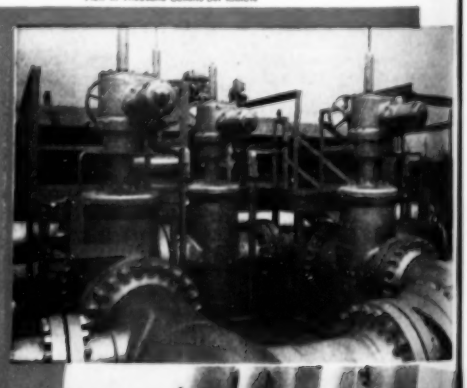
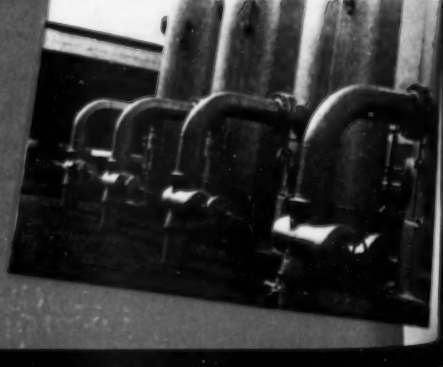
You're way ahead when you specify W-K-M—not only do you get far greater transmission efficiency, but you get leverlock operation, positive seal on both sides, spot lubrication at seat, and other advantages, all of which have made W-K-M Valves first on the world's major pipelines.





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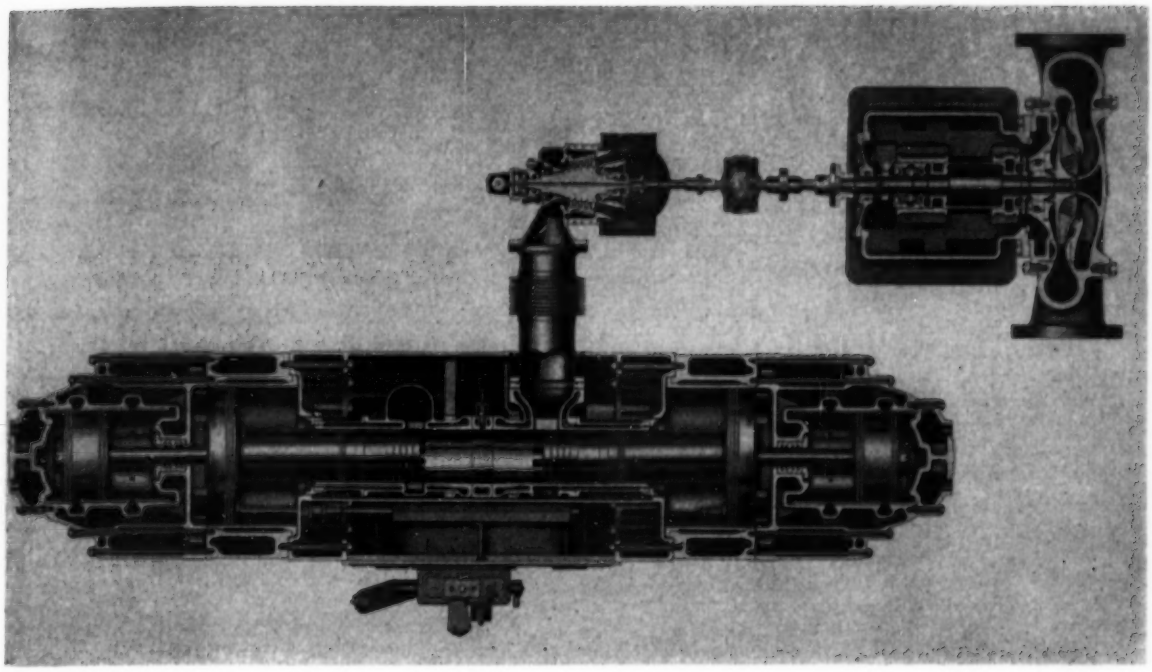


The gas turbo-compressor unit.

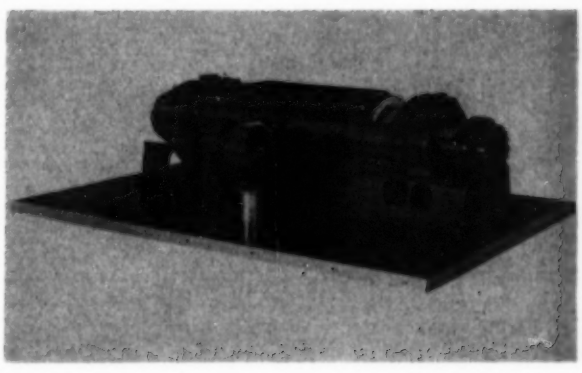
The free piston turbine prime mover

An explanation of the principles of operation and a clarification of some common misconceptions

THE race between all types of prime movers is hard and relentless. The all-rotating gas turbine must look toward higher pressure ratios and much higher temperature metallurgy and it must find simpler configuration with cheaper and better regeneration, reheat and intercooling. The crank engine designer is always striving for greater pressures and mep's, taxing the physical limits of connecting rods and crankshafts. The free piston turbine's future potentiality lies in its ability to convert tremendous energy releases through supercharging its own compressor and expanding outputs through greatly increased mass flow through the cylinder and the turbine. Extremely high specific free piston outputs can be obtained without increasing temperatures to the turbine and without sacrificing high thermal efficiencies and durability. Without bearings and crankshafts, but with the ability to control compression ratios, the problem of pressures is a simple one.

On the following pages there are drawings of the operating cycles and a description of some common misconceptions.

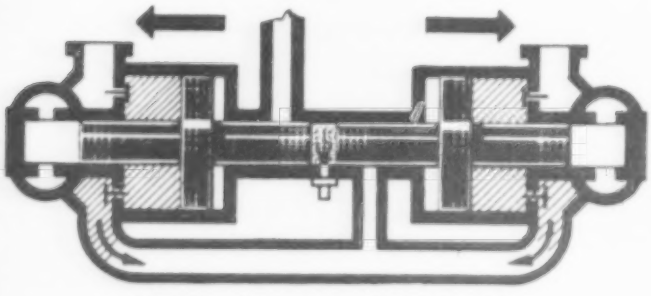
By ROBERT P. RAMSEY, Consulting Engineer
Cooper-Bessemer Corp., Mt. Vernon, Ohio



The 14-in. bore, free piston turbo assembly (1500) hp).

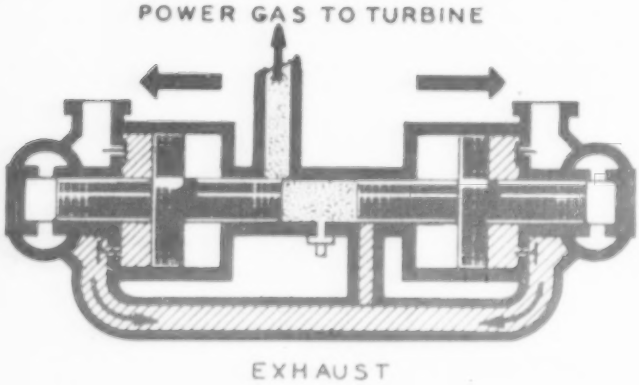
This article is adapted from a talk presented at the September conference of the petroleum division of the ASME.

Description of operating cycle



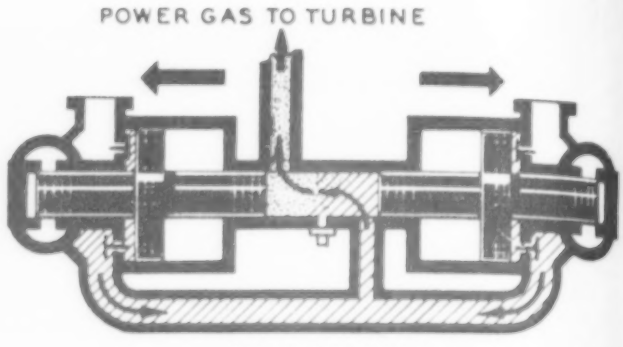
INJECTION & COMBUSTION

1. The cylinder is of the opposed piston uniflow type. The first position shows the fuel being injected into the combustion chamber and the pistons started on their outward stroke. Air which has been drawn into the large diameter compressor cylinder is being compressed and discharged through exhaust valves into the scavenging manifold. This air cannot enter the power cylinder because the piston covers the inlet ports. Similarly in the position shown, the exhaust ports are also covered by the exhaust piston.



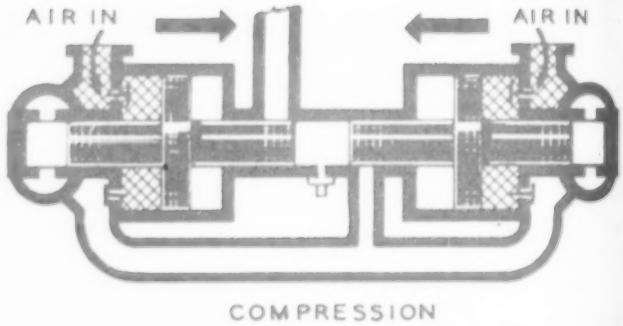
EXHAUST

2. The pistons are shown about half way on their outer stroke with the exhaust ports just opening. The inlet ports are still closed by the inlet piston. The combustion gas in the cylinder is starting to flow through the exhaust ports toward the turbine. It is NOT this particular blow-down energy that drives the turbine; however, it supplies SOME of the power. On the outward stroke, air is being compressed in the bounce cylinders and energy is being stored just as kinetic energy is built up in a flywheel of a crank engine. The compressor pistons are continuing to discharge air into the scavenge manifold under pressure.



SCAVENGING

3. The pistons are still moving outwardly. This is perhaps the most important diagram to study as the most unique feature of the free piston engine can be seen and properly understood. A great many people think that the exhaust energy as shown in Position 2 drives the turbine; however, in Position 3, it can be seen that the power pistons are still continuing their outward stroke and the scavenging air under pressure is flowing in through the inlet ports of the cylinder and pushing the exhaust gas through the exhaust ports to the turbine. In other words, the combustion push of the power piston is actually driving this air in behind the exhaust gases, and supplying most of the actual pressure energy to the gas column, which in turn drives the gas turbine. This is not unlike the push of a power piston, in a crankshaft engine, driving the connecting rod to turn the crankshaft. The efficiency of transmission of the cylinder energy to the load in the free piston engine is about 92%, while the mechanical efficiency of a crank engine is about 85%.



COMPRESSION

4. The pistons are moving inwardly on compression stroke. The energy stored in the bounce cylinders on the out stroke, like the kinetic energy of a flywheel, now drives the pistons back on the compression stroke. Air is being drawn into the compression cylinder through its inlet valves and the pressure-charged air trapped in the cylinder is being compressed preparatory to Position 1, where the whole cycle starts again.

Controls

It should be noted that since there is no physical crankshaft to fix the top dead center position of the pistons, the compression pressure would be regulated by the inward dead center compression ratio in *Fig. 1*, and this is determined solely by the energy conditions in the bounce cylinders. This in turn is set by a pressure regulating valve tied in with the engine governor. An increase of bounce pressure will cause the compression pressure to increase. A decrease in pressure in the bounce will cause the compression pressure to decrease. This is handled by a railroad type valve of very rugged construction.

The outward stroke determines how much air is discharged by the compressor cylinder at turbine pressure and this is a function of how much fuel is injected per stroke. The mass flow of gas through the engine is the thing that determines the power of the turbine and the pressure to force it through. The longer the stroke, the greater the mass flow and the higher the pressure built against the turbine inlet nozzle. It may easily be seen that in this type of power plant the stroke length, rather than the speed, or number of cycles per minute, corresponds to rpm in a crankshaft engine. A small amount of fuel injected means a short outward stroke. The engine will idle down to the point where just enough air flows through for sufficient scavenging to maintain combustion.

Timing of fuel injection or ignition is tied physically to this bounce pressure regulating valve and to the fuel throttle and in this manner all three of these functions link together to follow the characteristic curve of a gas turbine.

The author clears up some common misconceptions

1. There seems to be an idea in the minds of some people that the free piston cylinder will burn up because it is scavenged and charged with air at 50 to 70 lb pressure, and because proportionally large amounts of fuel are consumed.

The actual scavenging and charging air pressure has nothing to do with combustion temperature rise.

If one lump of coal will boil a gallon of water, five lumps will boil 5 gal., but if five lumps are burned under 1 gal. you will either get superheated steam or burn the bottom out of the pot.

The amount of air in combustion with a proportioned amount of fuel—in other words, fuel air ratio—determines temperature rise.

A free piston cylinder scavenged and charged at 70 lb air pressure may run at high output with lower temperature levels than an ordinary two-cycle engine with 3 lb scavenge pressure and very low output. In fact, a two-cycle engine with 3 or 4 lb scavenge pressure and at 50 lb mep can be burned up by lack of air causing high peak temperature and lubrication failure, whereas the free piston with 70 lb scavenge may run at 150 bmep or better at relatively low temperatures.

Many things such as the type of fuel, stoichiometric mixtures, porting, blow-through and other matters complicate the detail, but should not be allowed to befog the above basic issue.

2. Similarly, many people erroneously believe that the high scavenge pressure of a free piston engine will cause terrific peak pressures, which would burst cylinders, damage cranks, and blow gaskets.

It is true that a crankshaft engine operates with fixed compression ratio, the compression pressures and peaks become very high and would be expected to cause trouble at high boost pressure—but the free piston engine automatically adjusts its compression ratio as the scavenge pressure increases with load and stroke, and it can be made to hold relatively constant compression pressures if so desired. Since there are no crank or bearings in the free piston engine, there is some advantage to be derived in thermal efficiency by operating at higher peak pressures. However, compression volume is automatically adjustable while running. Pressure alone seldom breaks piston rings. High temperature will weaken rings and lubrication failure will cause scuffing and ultimate breakage. A high rate of pressure rise is always an offender in any engine, but in the free piston it is a controllable function, just as it is in any other engine through timing and fuel rate and distribution.

3. Some questions have been raised about the high mean pressures of the free piston engine as an index to rate of wear. They are not much higher in pounds per square inch than have been used for years in Cooper-Bessemer's four-cycle engines on 24-hour, continuous 365-day operation. True, this free piston is a two-cycle engine. However, extremely generous cooling is used and great attention to design has been given to cool the piston ring, the piston head, and the cylinder wearing surface. The cylinder is chrome-plated; care has been used in selecting the type of chrome and the metallurgy and surfacing of piston rings. Large excesses of air cool the surfaces and ports.

4. The free piston is often compared to the two-cycle crank engine, and questions are asked as to why these high meps are not taken out of crank engines. The only possible way this could be done, without excessive fuel wastage out the exhaust ports, would be through turbo-scavenging the two-cycle crank engine. There are many developments going on throughout the country on this two-cycle turbo idea right now; however, there may be mechanical limitation in fixed compression pressures, bearings, and cranks, but the free piston turbo is essentially a two-cycle pressure-charged engine in its final analysis, except that it does not have cranks and rods.

The free piston pumps a great excess of cooling air through the cylinder, controls its peak pressures, and its ported areas are cooled by the blow-through gases lying immediately outside the exhaust ports when the piston passes back over them. This air is cool and helps keep the exhaust cylinder port conditions the same as the inlet.

5. The question is frequently raised as to why the free piston is thermodynamically more efficient than other cycles. The real reason, of course, is that it has a very high overall expansion ratio. Combustion is at equivalent diesel pressure levels and this is expanded clear down to atmosphere, first inside the power cylinder then through the power turbine. A continuous combustion gas turbine, for instance, expands down from 5-to-1 as against 100-to-1 in the free piston. The ideal efficiency of a continuous combustion turbine by the air standard cycle is about 35% while the free piston turbo is 70%. In practice, seldom more than 50% of these values are achieved, due to departures from perfect gas laws, friction, throttling, dissociation and other factors.

6. There is another very common but erroneous belief that when higher turbine temperatures are attainable through new blade metallurgy, the continuous combustion gas turbine will immediately achieve high efficiency. This is not correct. If a ratio of 5-to-1 is selected for study and enough excess air is used to control the temperature to 1500°, the theoretical efficiency is 23%. At 2500°, the efficiency is 25%, and the efficiency goes to 26% at 3500° F. These values are calculated for 85% compression and 85% expansion efficiencies, with ideal 100% efficiencies for combustion, windage, etc., which are unattainable and only theoretical.

If a 3500° turbine could be built at an 80-to-1 compression ratio, it could just equal the efficiency of the free piston turbine plant operating with a 1000° turbine.

Of course, the continuous combustion gas turbine improves with regeneration, compounding, reheat and intercooling, but all of this adds more and more expense, complication and size to any basic gas turbine of the continuous combustion type.

If there is any reluctance to accepting the free piston cycle, it cannot be based upon engineering logic.

Of course, the "crank" dates back to a long time ago. It has become part of the background of mankind, so long taken for granted that it has almost, if not quite, become instinct. The crank was old when Aristole, Plato and Socrates were pondering the Universe and when Democritus was propounding his classical theories of the atom that remained with us nearly 2500 years. However, when we realize that it was 1918 when Planck received the Nobel Prize for his Quantum Theory and it was as

Gas replaces mud in new drilling technique

NEW YORK State Natural Gas Corp., Pittsburgh, pioneer user of the shaped charge for vertical shooting in drilling operations in the Clinton county, Pa., gas field, has introduced another new drilling technique to the Appalachian area with the successful substitution of air or natural gas for mud in the Benezette gas field.

Well production will be favorably affected and drilling time appreciably shortened by employment of the new method, in which air or natural gas is used as the medium for carrying cuttings out of the hole.

Use of the mud-drilling method necessitated a time-consuming change-over to cable tools at the casing point —the point just above the gas-bearing sands where the tools are withdrawn from the hole and production casing is set in place.

To eliminate the danger of combustible air-gas mixtures when gas-bearing sands are penetrated, the company now completes the drilling-in with gas from one of its nearby lines.

Cable tools are necessary with the new technique only where the firm has no lines available for tap.

While gas-drilling has been used extensively in one area of the southwest, the San Juan basin, the new technique is only now being put to practical use in other major gas and oil producing areas of the United States, according to corporation authorities.

Two major drawbacks encountered in mud-drilling have been eliminated with the use of the new technique: Unavoidable seepage of mud into gas-bearing sands, causing a partial block and resultant reduction of well production; and, in winter, fluid-freezing.

In addition, a statistical comparison of two wells, drilled under similar conditions, revealed that the air-drilling method results in a substantial reduction in total drilling time and a longer life for drilling tools.

Credit for introducing this revolutionary drilling technique to the Appalachian area is shared by Edward C. Inghram, general superintendent of New York State Natural, and one of the principals in the development of the shaped charge technique; and Guy White, vice president of Delta Drilling Co.

late as 1933 when Born reconciled the Einsteinian equations with the wave theory of light and put the atom in business, we get a rough idea of how hard it is and how long it takes to break away from the old concepts and do anything in a new way.

If the free piston idea is so good, why isn't everyone building them? The question is interesting and certainly deserves an answer. The first answer is, that everyone does not know how. Many people know crank engines, and we must remember that the free piston turbo is the infant among prime movers. The least is known and understood about it.

If the Navy had not financed the early work which was done in this country, it is very problematical when, if ever, any private industry would have spent its own money to do it. That Navy work opened the door to some understanding of the problems. It has taken a long time and a great deal of painstaking determination and money to get the job done.

Difficult to eliminate parts

It is always more difficult to engineer a job that eliminates parts than it is to do a job that permits the use of more and more parts. Some of the current compound engine thinking is derived largely because it is easy to understand, and if the compound engine is thought through to a conclusion, it does nothing that the free piston cannot do. Many of the principal parts like cranks and rods cancel out in the final free piston equation. The compound engine is thus handicapped. This has been a difficult engineering job, not an easy one. Many old techniques believed to be applicable from crank engine practice were tried, but could not be used. New ones had to be developed. One by one the problems have been solved: the fuel pump without a rotating cam; the piston with a head on both ends and no connecting rod or crank to fasten it to; the cylinder without a crankcase; the valves that work like the gills of a fish. The remaining work is refinement of detail, increased power through supercharging, and combustion with all of the commercial fuels.

What did anyone really know about gas turbines a few years ago? World War II provided about all that we now know. The newest of the gas turbine types is the free piston. It was conceived only yesterday, so to speak, and today its evolution is combining the high efficiency of the piston engine with the simplicity of the turbine.

There is no reason why a small, simple free-piston generator under the hood of an automobile or across the axle of a bus or truck cannot be built to drive a vehicle through a simple torque converting gas turbine. It is the only known way to produce a turbine drive that is more efficient than that of a crank type engine.

The locomotive, the tractor or the tank may be driven by the free piston turbine by development of what the engineers now know, with all the flexibility of electric drive and without the economic weight and cost penalties. In its presently developed form it appears to be ideally suited for the propulsion of cargo vessels, tankers and tugs, for pipeline pumping and for making electric power. It also produces large amounts of hot combustion gas under pressure, which may be useful in chemical processes, or in making power and supplying process heat cheaply, for vibrationless off-shore drilling, for use in vessels where noise transmission through water is important, and many other purposes. It seems feasible that individual units may be developed as large as 5000 hp per cylinder and there seems to be no actual limitation to the numbers and combinations which may be applied in one large power plant.

With all of these potentialities, why is this prime mover not being used for all these purposes? It is new. It has not yet proved all its obvious possibilities. It is not yet entirely perfected. It will have teething troubles in its early years. There is the keen competition of already highly developed mechanisms. It is known by few and understood by less. It is hoped that articles of this kind will be helpful to the engineering fraternity and will promote better understanding.

As long as petroleum and natural gas remain commercial fuels, the free piston cycle should have a very real contribution to make for a long time.

The free piston turbine prime mover is but one of several important recent developments in compressor engine design. Another is the turbocharged engine, already in use; and a discussion of its merits begins on the next page.

Turbocharging the two-cycle gas engine

By **C. A. CHAMBERLAIN** • Clark Bros. Co., Olean, N. Y.

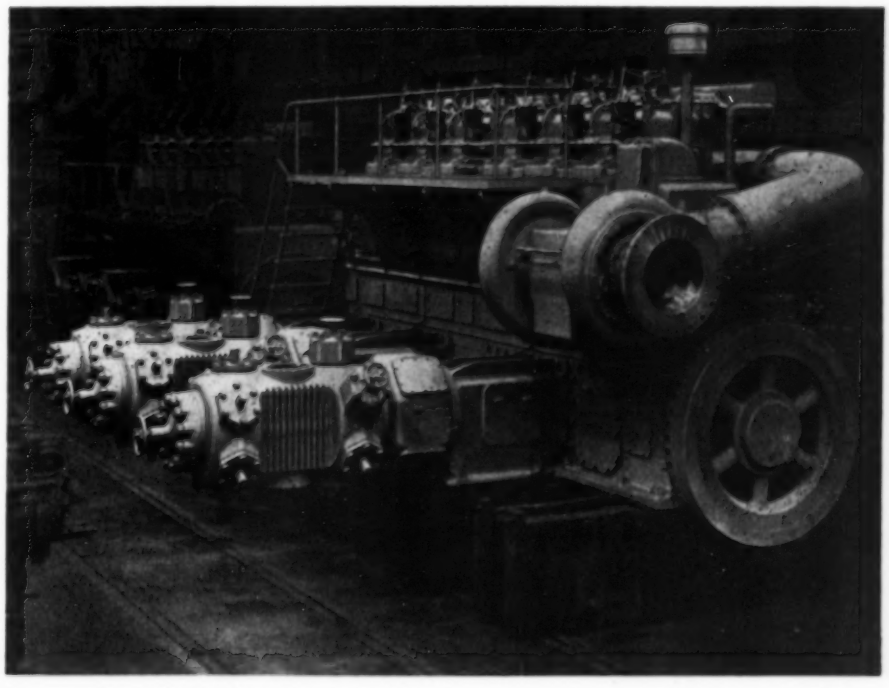
"Today we have equipment of such high efficiency that it has become possible to construct a turbocharger that matches the requirements of the two-cycle engine in spite of low exhaust temperatures. Indeed, with these new turbochargers we can pump an even greater excess of air for the engine than we previously did with the engine-driven pumps."

DURING the past 20 years there have been several distinct steps in the evolution of the gas-engine-driven compressor—steps so distinct that they serve as milestones in any discussion of the history of this particular type of equipment. This is especially true in the case of the two-stroke cycle style of engine. Recently there has been achieved another milestone which we feel is even more significant than any single previous step in the development of these engines. The two-cycle gas engine has been successfully turbo-supercharged, and the advantages that have arisen have exceeded our fondest hopes when this project was in the first stages of speculation.

Each of the steps preceding this latest development has brought about an increase in the thermal efficiency of the engine or an increase in the power output of a given size machine, or a significant lowering of the cost of installed horsepower. Outstanding among these have been (1) the introduction of fuel injection directly into the power cylinder, which resulted in a lowering of the fuel consumption from some 14 cf/bhp-hr to about 10 cf/bhp-hr; (2) the rearrangement of power and compressor cylinders from the old horizontal configuration to the present day angle style which cut installed horsepower costs considerably, and (3) the steadily increasing compression ratio of the power cylinders, which has made possible greater bmep and ever lower fuel rates. Proof that these steps have all been sound is to be found in the fact that they have been adopted almost universally by all engine manufacturers in this field, and by the fact that it has never been found necessary to recede from any of these advances. Since their original introduction they have continued to be used in practically all gas-engine-driven compressors to date.

Turbocharging of four-cycle engines has been a reality for many years. It was Dr. Buchi who first demonstrated the practicability of using a portion of the energy wasted in the exhaust of an engine to increase the pressure of the air being drawn into the engine. This resulted in trapping a greater mass of air in the combustion chamber of the engine and permitted the efficient burning of proportionately more fuel and an increase in horsepower output of the engine. With the wonderful advantage of hindsight we can look back now and realize how obviously this was achieved. A hot gas expansion turbine was placed in the exhaust system of the engine, thereby imposing on the exhaust a small back pressure which could then be expanded down to atmospheric pressure in the turbine permitting a certain amount of work to be extracted from the exhaust gas.

This back pressure, which had always been so carefully avoided in the interest of maintaining good volumetric efficiency of the engine, was no longer a disadvantage because the energy derived from the process could be used to drive a centrifugal compressor, and the air discharged from the compressor inducted into the engine at a comparably

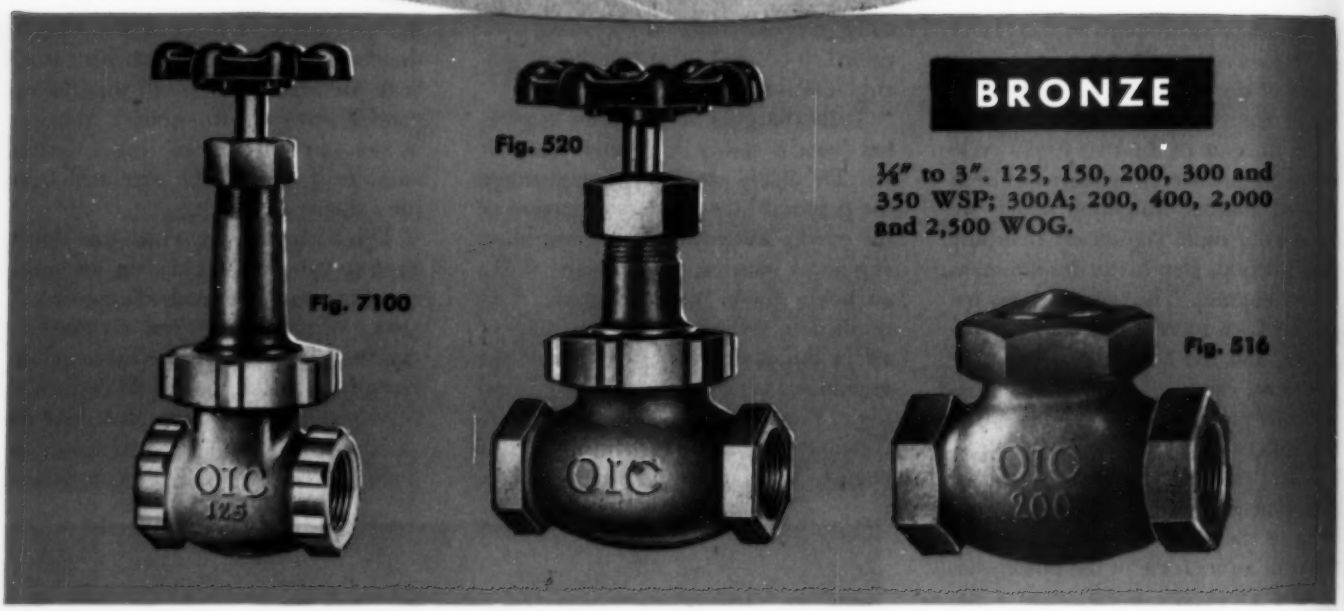


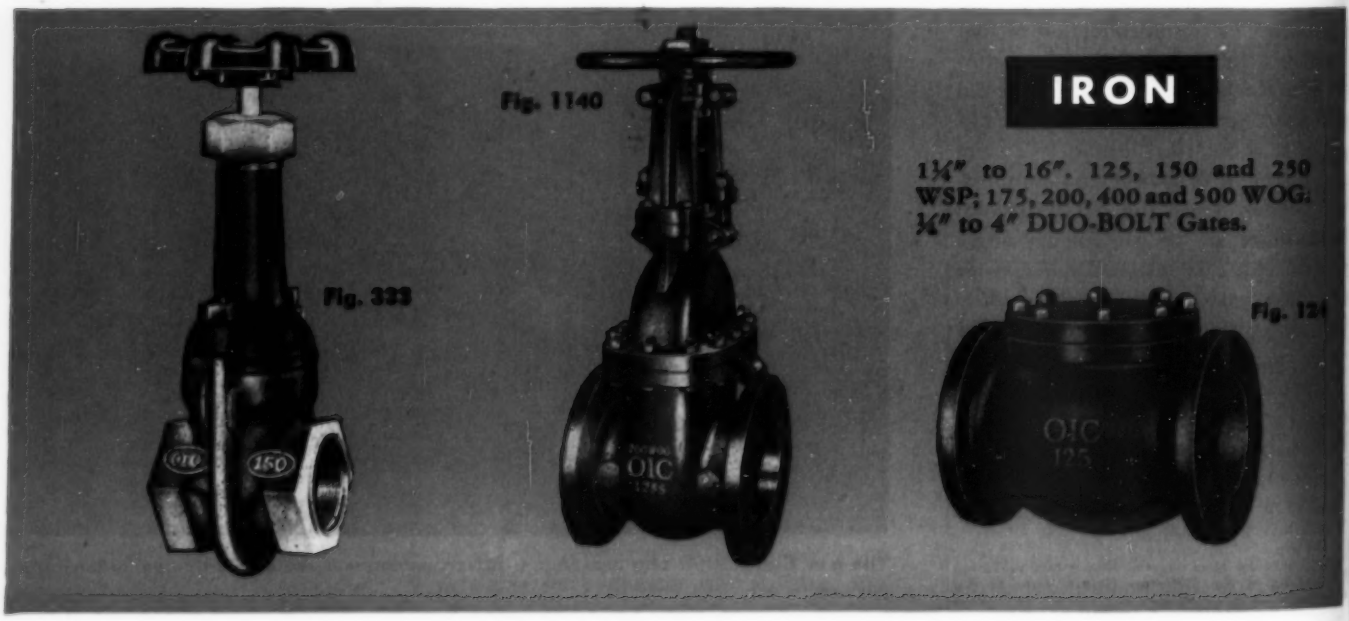
The new Clark 2000-bhp gas-engine-driven compressor requires only one turbocharger per unit.

This article has been adapted from a talk presented at a meeting of the California Natural Gasoline Association in April.

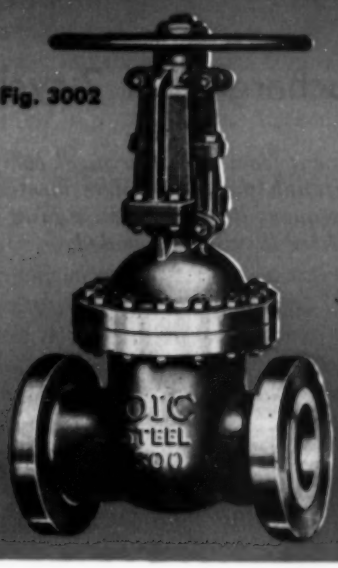
OIC Valves

...THE MODERN LONG LINE





CAST STEEL



2" to 16". 150, 300 and 600 lb. primary pressure series.

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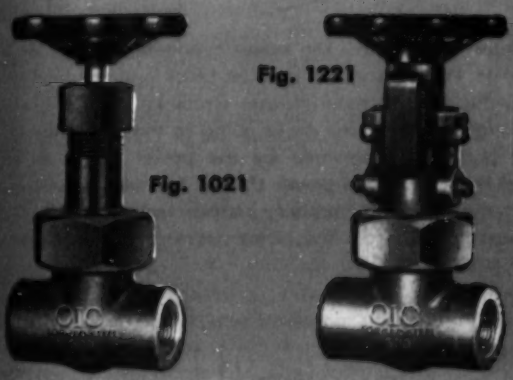

¼" to 2" Gate, Globe, Angle, Check Valves; 600 lb. primary pressure series.

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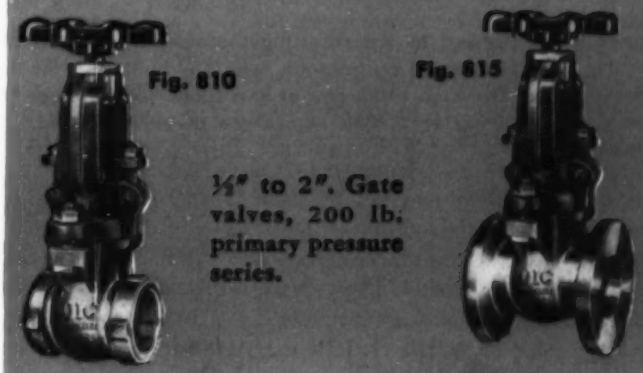
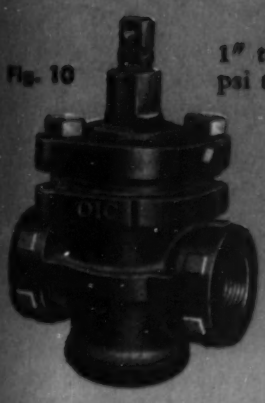


½" to 2". Gate valves, 200 lb. primary pressure series.

LUBRICATED PLUG



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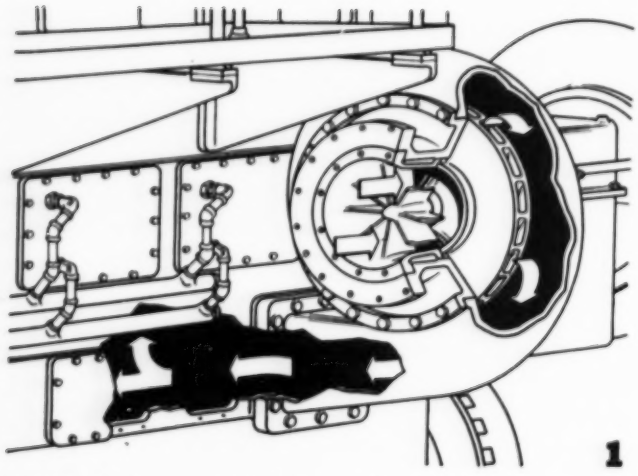
THE OHIO INJECTOR COMPANY

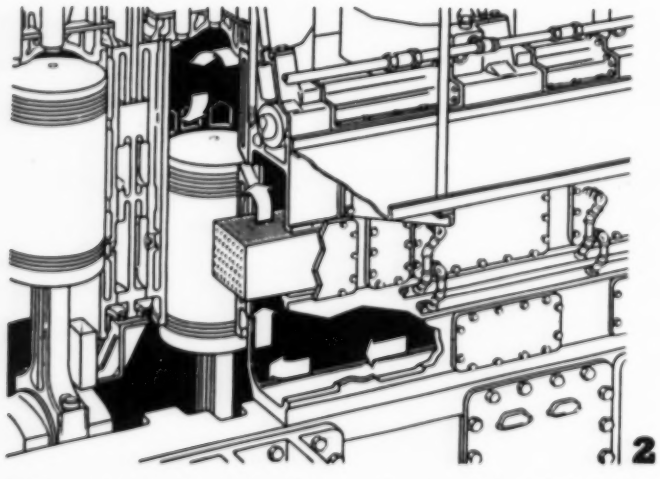
WADSWORTH, OHIO

This is how turbocharging of 2-cycle engines works

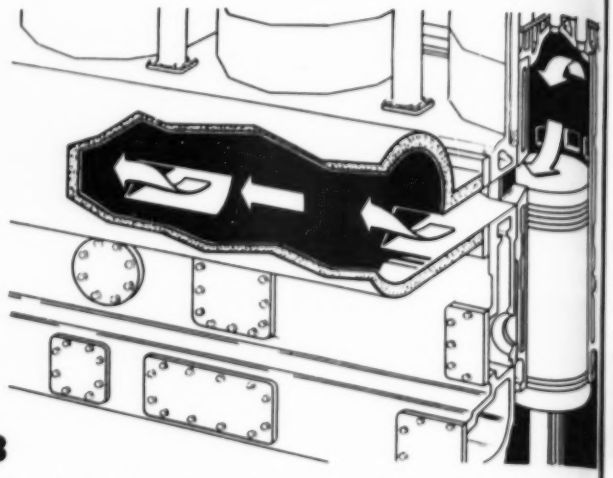
Sequence of air movement from the centrifugal compressor, through scavenging air passage, through the intercoolers located ahead of the power cylinders, and the subsequent flow of exhaust gases through exhaust ports and into the turbine where they are expanded.



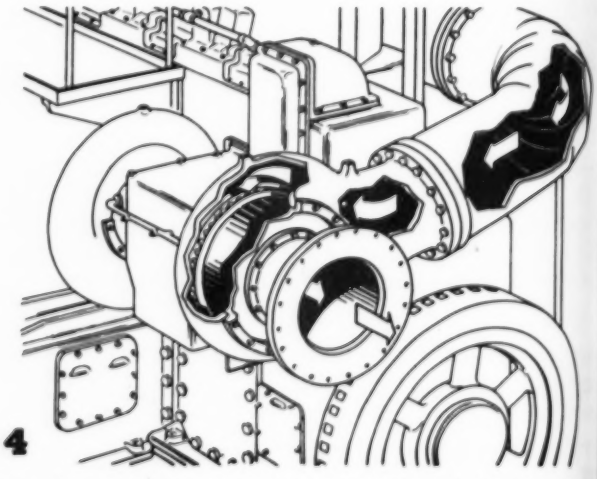
Filtered air is pumped by the centrifugal compressor impeller into the main scavenging air passage, which is built into the cylinder block. The high efficiency of the Clark turbocharger permits the pumping of a high percentage of excess air for cylinder cooling.



Before entering the power cylinders, the scavenging air is cooled in individual built-in intercoolers. The amount of water admitted to these coolers is thermostatically controlled, depending on the temperature of the air in the scavenging air manifold. Manifold air temperature is, of course, determined by the load on the engine and ambient air temperature. Air enters the cylinders through multiple directional ports. Thorough scavening is assured.



The exhaust gases leave the power cylinders through large exhaust ports. Passages in the cylinder block and the lead-in passages to the exhaust manifold are streamlined to assure maximum energy loss from the gases going to the turbocharger. The exhaust ports are uncovered by the power piston as it approaches the end of the power stroke. The piston subsequently uncovers the scavenging ports to permit clearing of the cylinder of exhaust gases before the piston starts upward on the compression stroke.



Hot exhaust gases enter the turbine of the Clark turbocharger where they are expanded in the radial inflo turbine. In expanding the gases, rotative energy from the turbine is used to drive a centrifugal compressor impeller, which pumps air for combustion.

elevated pressure. This had the same effect as operating the engine at abnormally high barometric pressures such as one might find at a hypothetical engine location considerably below sea level. Indeed, the similarity to the effect of arbitrarily increasing the barometric pressure at which the engine was operating was made use of directly in the turbocharging of four-cycle aviation engines. In this application, engine output could be maintained at its sea level value at altitudes as high as 30,000 ft. It is probably safe to say that it was this application prior to and during World War II that stimulated the development of turbocharged four-cycle engines to the degree at which we find it today.

Two-cycle engine designers looked wistfully upon this development and concluded that there were characteristics inherent in the two-cycle design that prevented them from availing themselves of the same advantage. These characteristics were:

1. The requirement that the air for the engine be forced into the power cylinders by some external pump inasmuch as the utilization of each downstroke of the power pistons as a power stroke left no idle stroke of the piston to be used as suction strokes to draw the air into the cylinders as was done in four-cycle engines.

2. The necessity of supplying a quantity of air considerably in excess of the displacement volume of the cylinders in order to efficiently scavenge the cylinders of burned gases from the preceding stroke during the brief interval when the pistons were near the bottom dead center of their stroke. This latter condition, as is well known, results in the lower exhaust temperatures of two-cycle engines, and because available turbine energy is directly proportional to the temperature of the gases entering the turbine, the turbine power was insufficient to drive a blower large enough to provide the quantity of air necessary to scavenge the cylinders.

In the past few years we have made notable strides in the development of the two basic components of the turbocharger, the expansion turbines and centrifugal compressors. This development has provided increasingly higher efficiencies in both components and today we have equipment of such high efficiency that it has become possible to construct a turbocharger that matches the requirements of the two-cycle engine in spite of low exhaust temperatures. Indeed, we have found that with these new turbochargers we can pump an even greater excess of air for the engine than we previously did with the engine-driven pumps. This additional excess air not only insures thorough, efficient scavenging of the engine but also provides a high degree of cylinder wall cooling during the scavenging period and thus helps to provide cool running conditions for the pistons and piston rings in the cylinders.

The employment of a blower of such high efficiency has resulted in scavenging temperatures no higher than those of the non-turbocharged engines even though the scavenging pressure has been increased to 7 psi at the rated load of the turbocharged engines. At ambient temperature above 75° as well as during periods of overload operation, built-in scavenging air intercoolers automatically come into operation to prevent the scavenging temperatures from exceeding 145°. This, coupled with the fact that a compression ratio comparable to that of the forerunning non-turbocharged engines is employed, means that the compression temperature of the fuel-air charge is no higher than it has been in the past. Detonation, being a phenomenon brought about most directly by excessively high compression *temperature,* is therefore no more likely than in previous engines.

Homogeneous mixing

In addition, we have found that the higher energy level of the circulatory flow of air in the cylinders, because of the greater density of the air charge during the scavenging period and the ensuing compression stroke, has resulted in a more homogeneous mixing of the fuel and air charge, and a consequential ability to burn a leaner mixture than before. This means that we have a lower temperature rise ratio during the combustion of the charge.

In reviewing these conditions we find, in comparison with the non-turbocharged engine, the same scavenging temperature, the same compression temperature, a *lower* explosion temperature, and a *lower* temperature at the end of the expansion stroke. Therefore, the mean temperature of the entire cycle is actually lower than that of a non-turbocharged engine. If the mean cycle temperature is lower, then it follows that the mean cylinder wall temperature must be lower. This has been found to be the case. It is definitely indicated by the fact that the heat transferred to the cooling water in the jackets of the power cylinders is 12% less per unit of area of the cylinder wall even though the brake horsepower has been increased 33%.

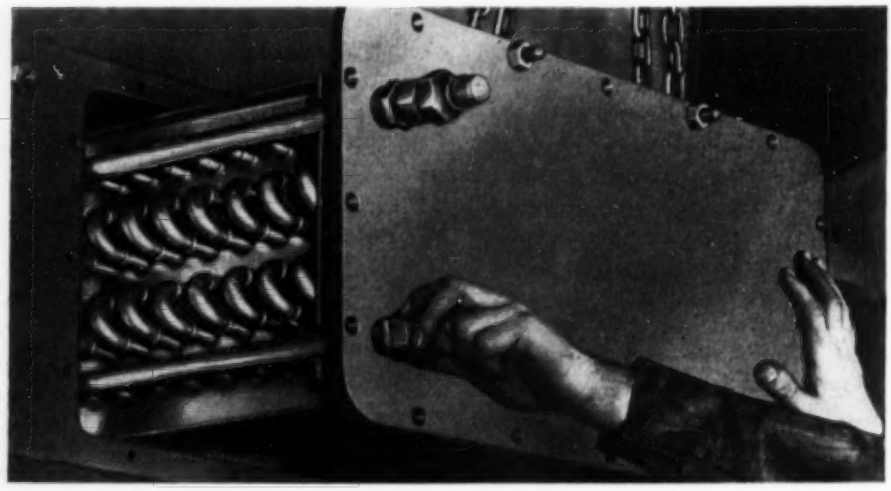
Now let us look at some more of the ramifications of this development. In the non-turbocharged engine, the power required to drive the scavenging pump came from the crankshaft of the engine. This has consumed from 8% to 14% of the engine output. In the turbocharged engine this work is done by the exhaust gas, a source of energy that was previously thrown away as a total waste. Therefore, the same net power output from the engine can be achieved with the consumption of that much less fuel. This has resulted in lowering the specific fuel consumption of these turbocharged engines to 7000 Btu/bhp-hr.

In the past, there was another apparent obstacle that stood in the way of turbocharging the two-cycle engine. As long as the engine required a flow of scavenging air for the initial combustion of fuel during the startup of the engine, and inasmuch as there was no source of air from an exhaust turbo-driven scavenging blower until *after* the engine was started, there seemed to be no means of getting the engine underway. Patents were issued many years ago covering an arrangement that would solve this problem. This consisted of employing an engine-driven scavenging pump either in series or in parallel with the turbine-driven blower. Start-up, then, was to be accomplished in a manner similar to that in a non-turbocharged engine. After the engine was started, the engine-driven pump was to be by-passed as the turbine-driven blower came up to speed.

While this system would work, it was never considered practical for several reasons. Even when by-passed, the scavenging pump inevitably left some parasitic load on the engine, lowering its efficiency, and in addition, almost any by-passing system involved a pressure drop in the intake or discharge system of the turbine-driven blower. These losses were excessive in view of the requirements of the turbocharger, which are stringent at best.

As is the case of any combination of blower, heat source and turbine such as combustion gas turbines, the characteristics of an engine turbocharger are such that the rate of turbocharger acceleration, from a given speed and for a given turbine inlet temperature, goes down as that speed is decreased. If the

Extremes in turbocharger deceleration where engine stalls might occur have been prevented



Individual scavenging air intercoolers are provided for every cylinder on Clark turbocharged compressors, assuring detonation-free operation even under temporary overload conditions in areas of high ambient air temperatures.

turbocharger is allowed to slow down excessively as the engine load is decreased, it will reach a point where a rapid reapplication of the load on the engine will cause the engine to stall because of the over-richness of the mixture while the turbocharger is slowly accelerating.

The solution of this problem has, in addition, provided a very satisfactory method of dealing with the starting requirements. A hydromechanical drive has been provided from the engine crankshaft to the shaft of the turbocharger. This drive incorporates an overrunning clutch and a hydraulic coupling. It consists of a chain drive to an 800-rpm lay shaft in the turbocharger. A gear train increases the speed to 2000 rpm at the input of the hydraulic coupling. Another gear and pinion on the output side of the hydraulic coupling increases the speed of the turbine and blower shaft to 6700 rpm. The maximum power which the drive must transmit is a small fraction of the ultimate power absorbed by blower. This maximum occurs, of course, with no load on the engine at which condition the engine exhaust energy is at a minimum. As the load is applied to the engine and the exhaust temperature starts to rise, the power transmitted by the drive steadily decreases until it reaches zero at about 75% of the rated load of the engine. At this point a torque-sensitive device indicates zero torque transmission by the drive and in turn causes the oil to be drained from the hydraulic coupling. This allows the turbocharger to free wheel at whatever speed the engine load demands.

Thus, in the operating range between 75% and 120% to 130% of rated load, the turbocharger provides a scavenging pressure and quantity of air that is ideally suited to each engine load. This means that the fuel-air mixture is maintained at a value consistent with smooth, regular combustion. The quantity of excess air proportionately increases with load; therefore, the power cylinders run nearly as cool at overload conditions as they do at rated load. The engine exhaust temperature actually drops off somewhat as the load is increased above its rated value.

Conversely, as the load on the engine is decreased the turbocharger slows up, providing a lower and lower scavenging pressure and a relatively constant fuel-air mixture, until again, at approximately 75% of rated load, the hydraulic coupling fills with oil and prevents the turbocharger from decelerating any further.

While the turbocharging of the engine has permitted an increase of 33% in bhp, it should be noted that the increase in indicated horsepower is only 15% due to the removal of the parasitic scavenging load and the higher mechanical efficiency. This means that the mechanical stresses to which the engine is subjected are increased by only 15%. At the same time it should be remembered that the thermal load of the engine has not been increased at all. In spite of this comparatively small increase in the mechanical duty of the engine, the manufacturer has felt that the optimum performance and dependability could only be achieved by completely redesigning the engine for this turbocharged type of operation.

The most basic change in the design is the adoption of the enbloc type of construction with the removable power cylinder liners in place of the individual cylinders, which characterized previous engines. This has provided not only greater structural strength and rigidity but has made possible several features that contribute to the improved performance of the engine. Perhaps most significant among these is the streamlining of the air and exhaust passages at the points of high velocity approaching and leaving the ports of the cylinder liners. This is essential for maintaining a low pressure drop from blower discharge to turbine inlet, which in turn makes possible the high degree of supercharging with comparatively low exhaust temperatures. This construction has also made possible the locating of the scavenging air intercoolers just upstream of the cylinder inlet ports, giving an individual cooling section for each cylinder. This location prevents any possibility of the air picking up heat from the engine parts after being cooled. The coolers also act as flame arresters, preventing the ignition of any fuel which might have penetrated into the induction system of the engine during a shutdown.

In general, bearing sizes have been increased considerably. In the 14 by 14 turbocharged engine, for example, main bearing area has been increased 22%, crankpin bearing area 9%, power piston wrist pin area 20%, and compressor cylinder crosshead bushing area by 150%.

More than 2000 hours of running time had been accumulated on these engines in the shop at the time of visiting. The first production engine, an 8-cylinder 14-in. by 14-in., has run an additional thousand hours at rated load on one of the major transmission pipelines in Tennessee. This operation has been eminently successful. Eight of the 17-in. by 19-in. engines have been delivered to another of the pipelines in Louisiana and Tennessee and will soon be in operation. Several more of the 14-in. by 14-in. will soon be on their way to a chemical plant in Texas. So we hope, and confidently expect, that there will soon be much evidence from the field that will explain our enthusiasm for these new engines.

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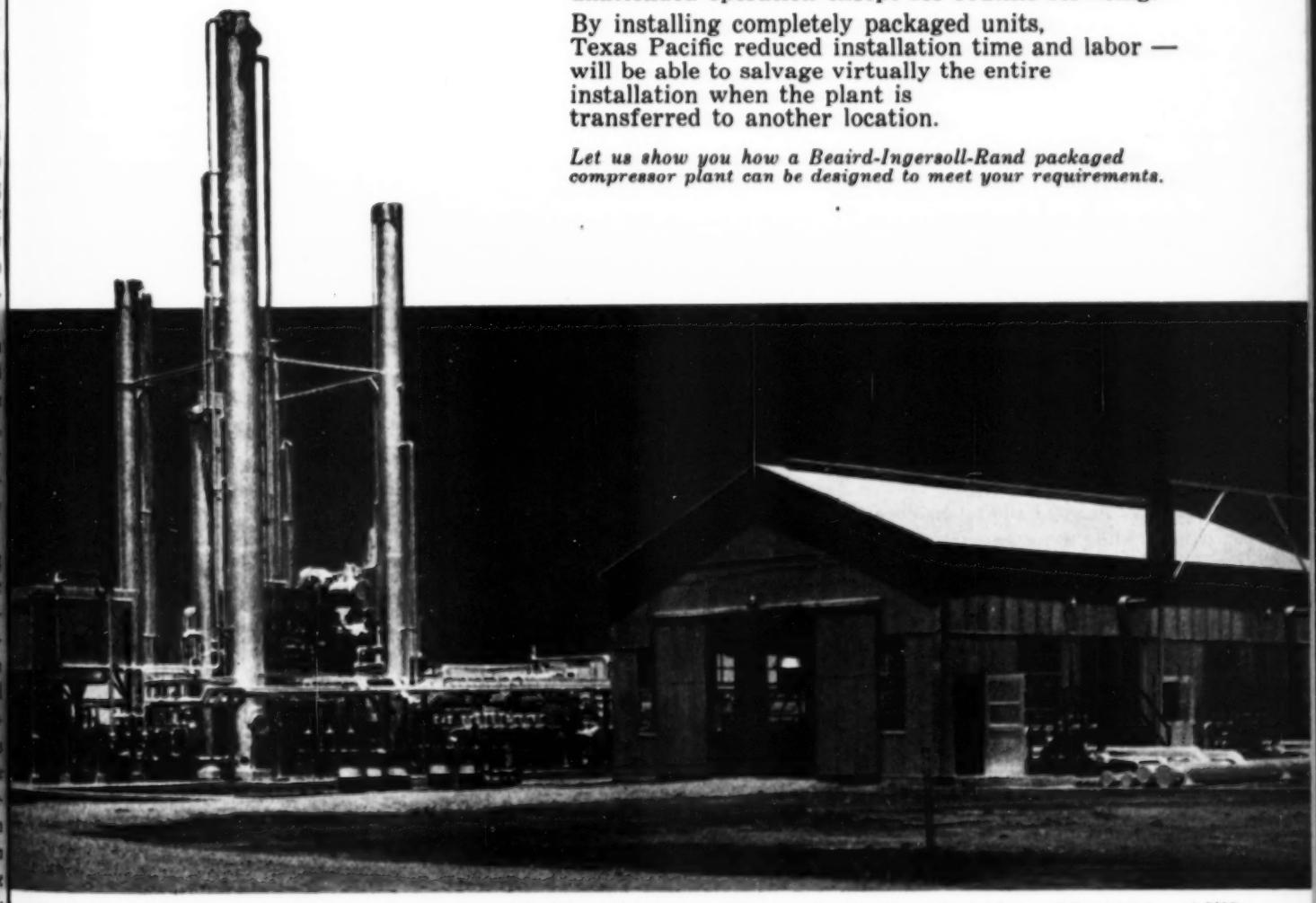
To assure continuous operation, Texas Pacific installed two packaged units rather than one large compressor of equal horsepower. Plant pressures and operations can be maintained, when necessary, by one unit, while the other unit is shut down for maintenance or repair — with the loss of only a portion of the plant's total producing capacity. Automatic controls built into the units permit their unattended operation except for routine servicing.

By installing completely packaged units, Texas Pacific reduced installation time and labor — will be able to salvage virtually the entire installation when the plant is transferred to another location.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements.



xas Pacific Coal and Oil Company's packaged compressor plant, Velta Plant, Fisher County, Texas—equipped with two Beaird-Ingersoll-Rand 550 h.p. 10 SVG OUR CYCLE gas engine driven compressors, Young radiators and all necessary equipment and controls. Other sizes 110 to 660 h.p.

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Pipeline Communications and Electronics

By FRANK CHAPMAN

Trailer mounted VHF station serves many purposes

A TRAILER-MOUNTED VHF base station that can easily be pulled by a company truck or automobile has solved a great many communications problems offered by El Paso Natural Gas Co.'s widespread and varied operation. The unit was designed by L. G. Wainman, superintendent of communications for the company, and members of his staff.

The station consists of a conventional 30-watt, 2-way VHF radio unit of the type ordinarily installed in automobiles or trucks, completely contained, including antenna and auxiliary power supply, in a small two-wheel trailer. The equipment is powered either from an Onan or Kohler auxiliary generator, or from a commercial power source.

The station may either be operated from the trailer or taken entirely out of the trailer and installed as a bare station in a building or tent. When operated from the trailer, a water-tight canvas cover is raised and held on stakes to protect the equipment and operator from the weather. For remote operation, the control panel and microphone may be removed from the unit and taken to a nearby building or other enclosure while the radio equipment remains in the trailer. The kit is equipped with long extension cords for this purpose. The antenna may either be installed on the trailer or removed for installation in a more favorable radio location.

One of the widest uses to which the equipment has been put is in the transmitting or relaying of messages and other information from remote locations in the producing fields to the nearest fixed station. It is usually necessary to transmit a considerable amount of information from such a location when drilling or some operation requiring personnel is under way. Messages pertaining to drilling time, the emergency need for repair parts and payroll information are a few examples of the kind of traffic that is handled over such a circuit.

The unit has been particularly valuable as a safety measure in field operations. Where one or two men are left alone on a job, such as on a drilling rig, the movable base can be used to provide them with a means of securing help if and when there is an accident.

The trailer-mounted station can also be used to advantage to span a wire line break in rugged country where immediate repair is not possible or on a section of line where it is essential that communication be maintained. In an instance of this kind movable units are set up on each side of the break.

The equipment is also used extensively on pipeline construction spreads along with the mobile units ordinarily assigned to the spread. In this application the movable station acts as a base station to operate with the 10 or 15 mobile units that work with the spread.

The movable base station may be brought into play in various ways when there is a pipeline break. In a case of this kind the unit is usually rushed to the location of the break while mobile units or "walkie talkie" sets are dispatched to the valves on each side of the break. The size and importance of the break will dictate how many mobile units and movable bases are used in the operation.

El Paso's trailer-mounted VHF station.

If the pipeline break should happen to be located in a blind spot from where it is impossible to maintain satisfactory radio contact with other mobiles in the area, the movable base may be set up at a nearby location where it can be used as a relay point. In an instance such as this there may be need for more than one movable base unit.

Although the equipment has already been used for many purposes, Mr. Wainman feels that other applications will become apparent as operating personnel become more familiar with how the station can be put to use.

First packaged microwave announced by RCA

The first commercial packaged microwave radio station—a compact, weatherproofed metal cabinet, housing complete transmitting and receiving equipment for "line of sight" on-hop point-to-point communication—has been announced by the Engineering Products division, Radio Corporation of America.

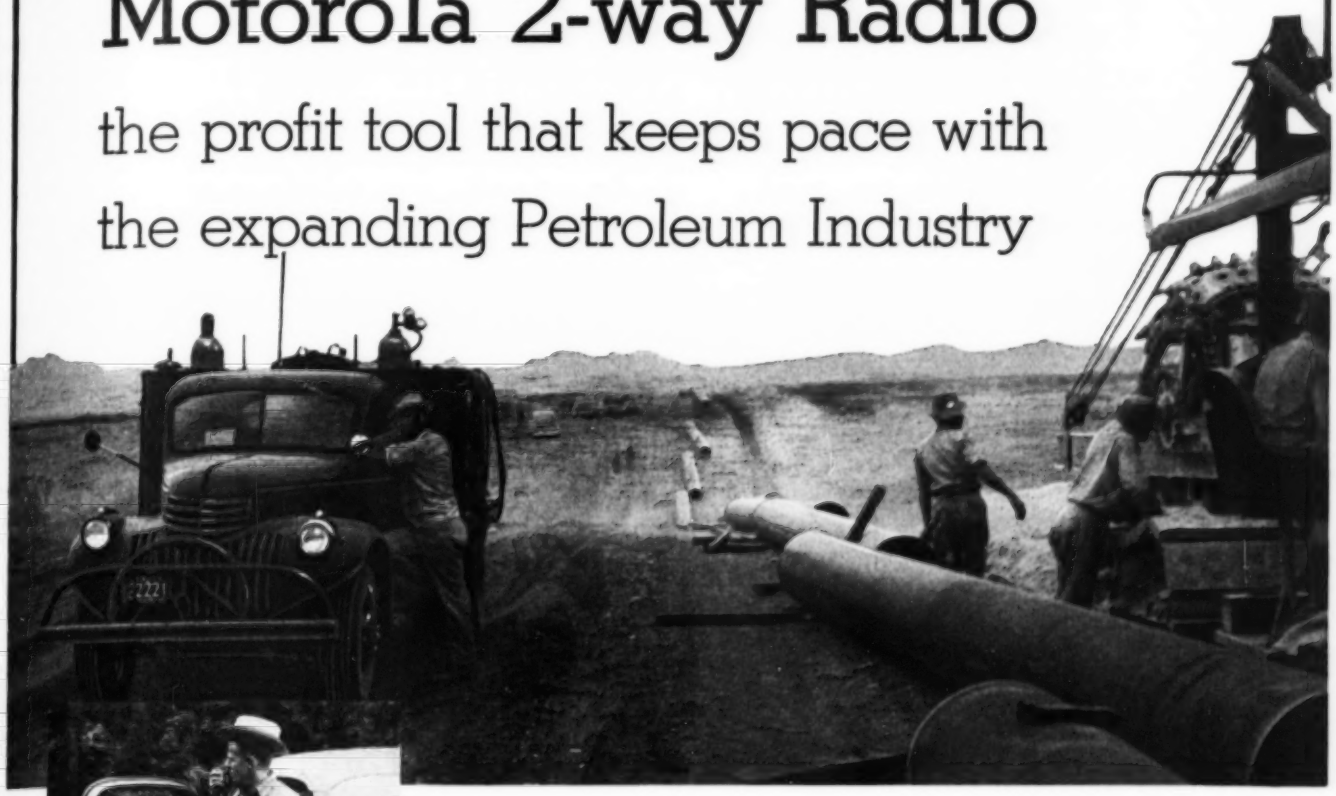
Believed to be the lowest priced microwave station ever marketed, the novel packaged station will cost less than $3000, depending upon antenna and line requirements, according to C. M. Lewis, manager of communication marketing. If more than one channel is required, multiplex equipment which will provide two voice channels with signaling can be installed inside the cabinet. Additional voice or telegraph multiplex units, installed in a similar housing, can also be connected to the radio equipment.

The equipment (MM-9) introduces new simplicity and economy in a wide range of microwave radio applications, he said. It is particulary designed for the economical requirements of such circuit operations as remote VHF control, voice communication, facsimile telegraph, telemetering, and supervisory control applications.

These stations can be tied in with an existing microwave system for side-circuit operation, or be used to provide a point-to-point one-hop system. The range can be extended by mounting two of the packaged stations back-to-back for multi-hop repeater station operation.

Motorola 2-way Radio

the profit tool that keeps pace with the expanding Petroleum Industry



On a remote strip of pipeline, a road superintendent exchanges some critical information with his spread foreman some 22 miles away saving several hours delay of another complete work unit.

Alert dispatcher "quarterbacks" important movements far and wide while his hourly record shows proof of tremendous accumulated savings in time, equipment, fuel and customer good will.

Oil and gas production and distribution is being maintained today by hundreds of companies with the direct help of Motorola radio communications.

Easily integrated into your existing operation—for improvements in customer relations, maintenance schedules, employee relations, cost control, and a multitude of minor problem areas.

Remember! To attain maximum performance at maintained minimum cost per unit per month—most companies insist on Motorola equipment to do the job. They have learned from first hand experience to count on superior and reliable performance . . . and they have found:

It Pays to operate Your Own 2-Way Radio Communications, the tool pioneered to practical success by the world's largest exclusive radio and electronics manufacturer

Motorola . . . the complete supplier of radio communications and industrial control, microwave relay, power line carrier, supervisory control, frequency shift V.F. carrier, mobile communications, and telemetering equipment.

national **Motorola** RADIO COMMUNICATIONS service **2-way Radio**

Motorola Communications & Electronics, Inc.
A SUBSIDIARY OF MOTOROLA, INC.

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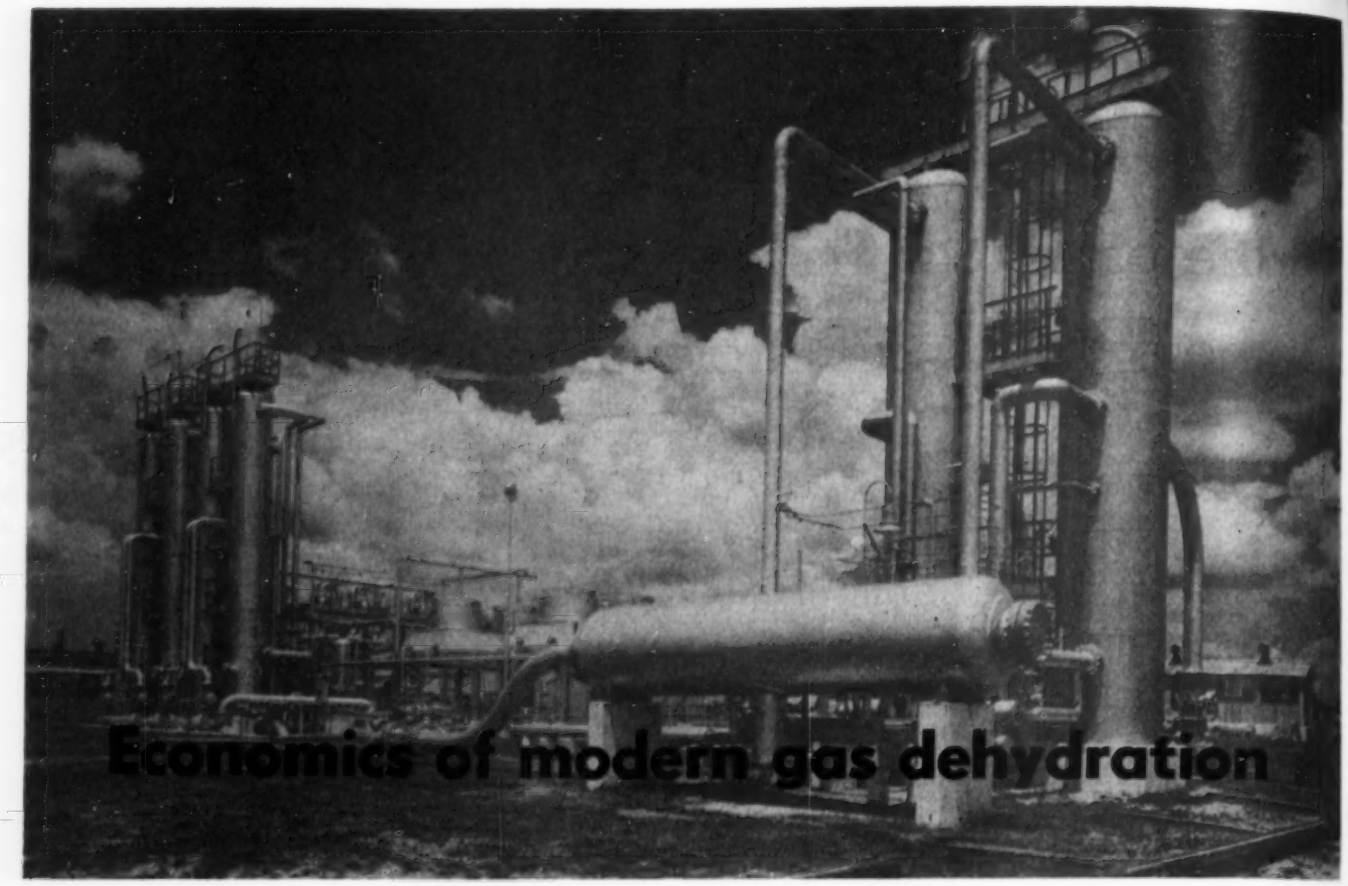


Economics of modern gas dehydration

By **A. H. WEIL** • United Gas Pipe Line Co., Shreveport

Because of the increasing movement of natural gas through long-distance lines into colder climates, the search for more economical methods of accomplishing the unprofitable job of dehydration has been stimulated in late years. Four systems are presently in use, and each has significant advantages and disadvantages from both physical and economic standpoints that must be considered before a selection is made.

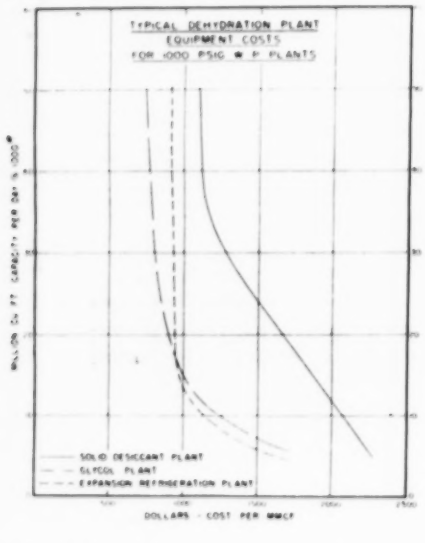


Fig. 1. Average equipment cost for various types of plants mentioned for the capacities indicated.

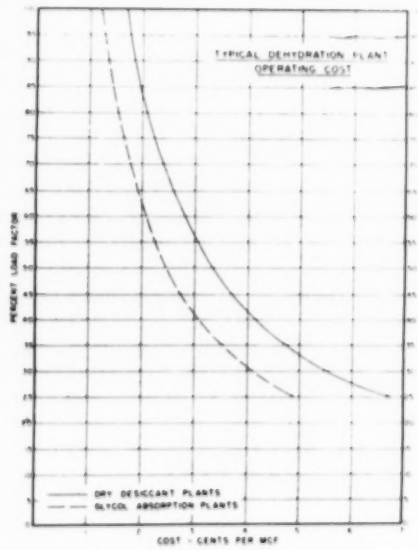


Fig. 2. Comparative operating cost for glycol absorption plants and solid desiccant plants.

WHEN the first natural gas dehydration plant was constructed and placed in operation during the 1930's, economy of the operation was not the primary consideration. Most of the effort was directed to the development of an apparatus that would accomplish the desired end—that is, the removal of free water and water vapor from gas streams at elevated pressures, which became necessary about that time to permit the cross-country transmission of natural gas.

When the automobile was first invented and placed on the market, it could be afforded by very few people until inventive genius devised ways and means, such as production-line methods, to reduce costs and place this convenience, which has now become a modern necessity, into the hands of the public generally. In like manner, dehydration of gas in the beginning was needed only by the owners of the early transmission lines and the first plants were relatively expensive and inefficient affairs.

Within the past 10 to 12 years the

This article is adapted from a talk presented at the NGAA convention in Dallas in April.

Advantages and disadvantages of various dehydration systems

Glycol plants

Advantages:

1. Low pressure drop.
2. Wide range of operating capacity, i.e., low turn down.
3. Applicability in presence of materials that might "poison" dry desiccants.

Disadvantages:

1. Dew point depression is less than with dry desiccants.
2. Foaming is possible in the presence of heavier hydrocarbons and extraneous materials.
3. Efficiency is lost from excessive water dilution if plant is not properly protected.
4. It is not readily portable in larger sizes.
5. More personnel and closer attention is required to operate.
6. The presence of more moving parts requires more maintenance and attention.
7. Temperature of gas should preferably be below 85° F.
8. Dew point depression is limited in most cases to 60° F at 1000 psig.

Solid type plants

Advantages:

1. Temperature of gas may range up to 125° F.
2. Essentially "bone dry" gas (less than 1 lb per MMcf) can be produced.
3. There is effective dew point depression over wide range of operating temperatures.
4. It is compact.
5. There is somewhat more hydrocarbon recovery than is the case in glycol dehydration.
6. In some instances, the rated capacity of the plant may be increased by bypassing some wet gas and recombining with the dry stream and remain below the dew point needed or specified.
7. It is more readily adaptable to skid-mounted construction, which increases portability.
8. Its automatic features permit minimum operating and maintenance expense.

Disadvantages:

1. Initial investment is higher.
2. Pressure drop is higher than with liquid systems, which increases pressure drop or compressor requirements.
3. Rated capacity declines rapidly with decline in pressure.
4. Where no external cooling is available, the ratio of regenerating gas at flow rates below rated capacity is high, resulting in excessive outlet gas temperatures.

Low temperature equipment

Advantages:

1. Where pressure drop is required, such as at a wellhead, this is usually the lowest cost system.
2. Condensate recovery is increased.
3. When sufficient pressure drop is available, this equipment gives low dew points.
4. Its simple automatic operation requires minimum attendance.

Disadvantages:

1. It is restricted to those applications where a large pressure drop is available.
2. It loses its effectiveness if pressure declines and must be supplemented or replaced by other equipment.
3. There is a possibility of low carbon steel embrittlement and equipment failure if operated below minus 20° F.
4. Special provisions are often necessary to prevent formation of hydrates ahead of the unit.
5. Intermittent operation, which is often necessary to comply with well proration and load variations, does not permit efficient operation at all times.

Glycol injection systems

This system combines the advantages of both the glycol absorption system and the low temperature extraction unit. One of the principal advantages is that the desired refrigeration can be obtained with a lower pressure drop. A principal use for this system is the transportation of gas from wells located offshore or in marsh country where hydrates may form before the gas reaches the point where water and condensate must be removed.

Some of the disadvantages are its higher operating and maintenance costs, higher initial investment and the necessity of returning the glycol after reconcentration to the point of injection.

---

sale of gas to the long-line transmission companies has required that the owner of even a single well meet specifications that permit not more than 7 lb of water per million cubic feet of gas and sometimes even less. This means that there was created a demand for equipment which is within the reach of the smallest operator so that he could get into the market, and the genius of American equipment operators has met this demand and made the equipment available.

Some of the early methods of gas dehydration employed calcium chloride, lithium chloride, calcium bromide and other inorganic compounds, most of them costly installations that produced questionable results. The need for improved techniques was ever present and led to the accepted present-day methods of dehydrating in plants using:

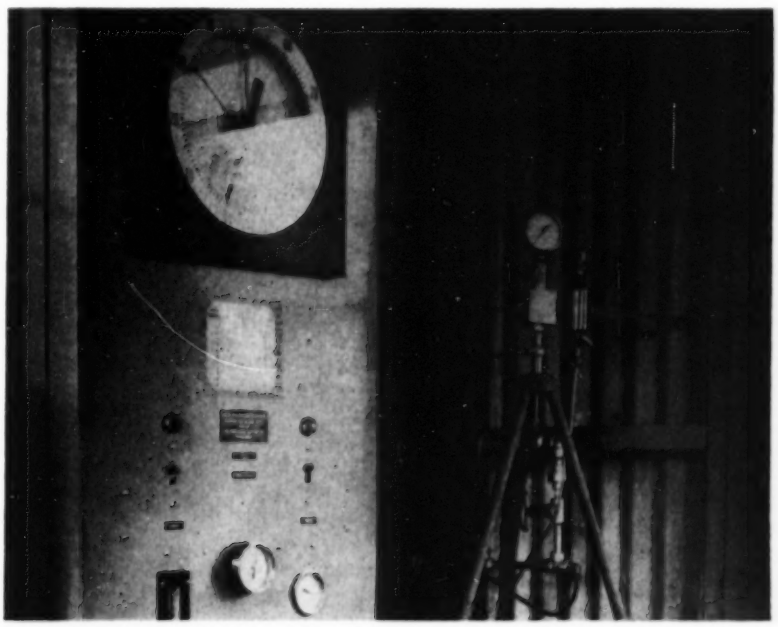


Fig. 3. Recording dew point machine developed by Bureau of Mines.

1. Glycols, either di-ethylene or tri-ethylene.
2. Solid type desiccants, such as bauxite, alumina, silica-gel or combination of these materials.
3. Low temperature equipment which takes advantage of the refrigeration created by expansion of the gas where adequate pressure is available.
4. Glycol injection systems.

The final choice as to which method of dehydration is the most economical depends mainly on two factors: the cost factor and the determination of which type of unit will meet the specifications set up for the process.

Considerations

Some of the specific factors that will determine the type of plant to be employed and that must be taken into consideration in reaching the final decision on the one to be selected are listed in the accompanying box.

Fig. 1 shows the average equipment cost for the various types of plants mentioned for the capacities indicated. These costs represent f.o.b. factory prices since it is felt that final cost depends on location and other auxiliary facilities, which vary considerably between various owners.

The selection of the type of dehydration equipment should always be based on an engineering study in an effort to meet the requirements of the work to be performed at the lowest possible cost. Other factors to be taken into consideration are the long range variations in temperature and pressure of the incoming gas and the requirements of dew point depression to be met in accordance with either the specifications of the purchaser, or as required for pipeline transportation by the owner.

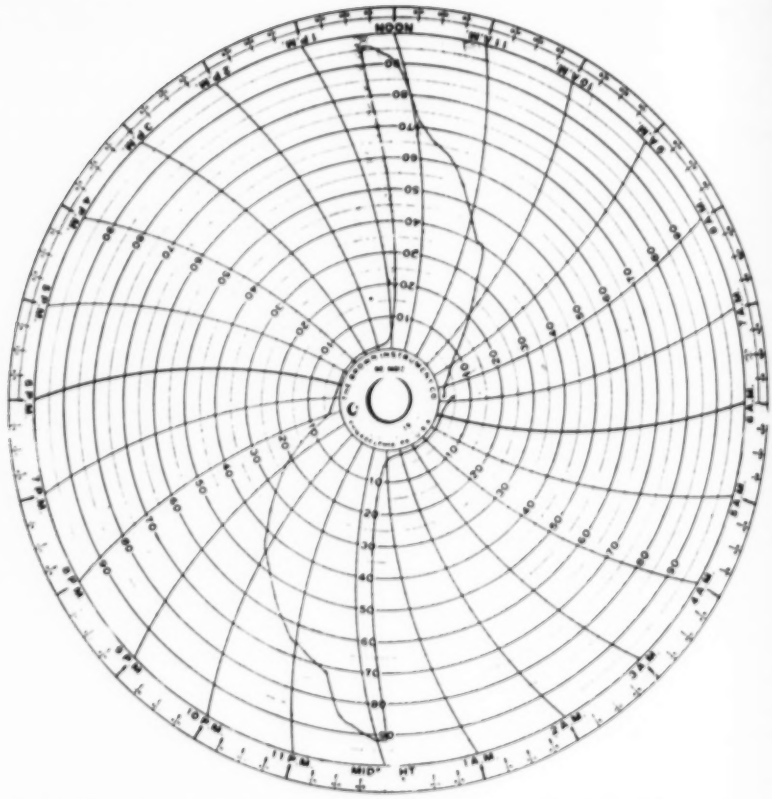


Fig. 4. Recorder chart showing how the beds in a unit were taken to maximum allowable saturation limits.

Fig. 5. Typical record of the control that can be achieved when blending wet and dry gases.

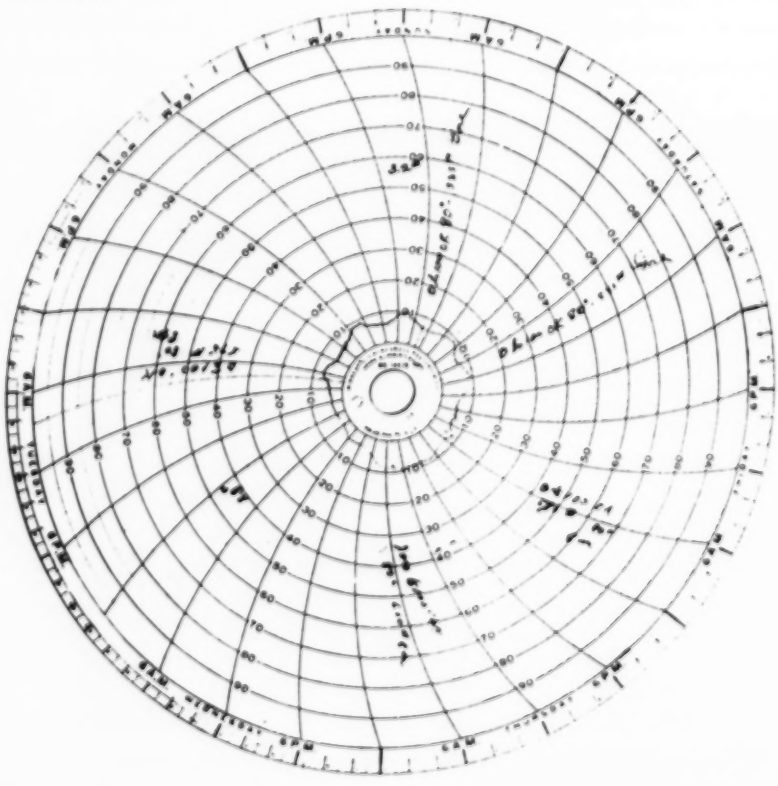


Fig. 2 shows the comparative operating cost for glycol absorption plants and solid desiccant plants. There is no operating cost shown for the refrigeration expansion plant because this type of plant is usually used on the lease as a wellhead plant and the operation cost is usually included inseparably with other lease and production expenses. This is a minor part of these expenses so that to assign a true operating cost to this type plant is almost impossible.

Plant load factor

Our experience also indicates, as demonstrated in the curves of *Fig. 2* that the unit cost of dehydration per Mcf is a function of plant load factor. It is, therefore, important in selecting a plant for a given location that it be designed to operate under the highest possible load factor. Since dehydration equipment is non-revenue producing, it is good business and good engineering to limit capital expenditures to a mini-

mum of equipment necessary to do the job. Such practice also pays dividends in lowered operating costs.

Operating expense

As has been demonstrated, both the initial cost and operating expense per Mcf of the glycol plants are somewhat less than with solid desiccant type plants; at the same time, the application of glycol dehydration is somewhat limited. For example, for gas that is produced, dehydrated and transported for ultimate use in the latitudes where the temperature of the gas will never be lower than 40° to 50° F, the use of glycol is definitely indicated and such practice has been proved in my own company's experience; but where gas is destined for transportation and consumption in colder latitudes, or where it is to be subjected to refrigeration prior to removal of liquefiable hydrocarbons or other types of cold processes, it can be more effectively and economically dehydrated by the use of solid desiccants and in some isolated cases by the use of low temperature separation equipment.

If equipment has been selected to operate normally on 70% to 75% load factor, which makes an allowance for peak-day operation at a 20% to 25% increased load, the average cost falls into the ¼-cent-per-Mcf range.

If the load factor becomes 50% and less, then the cost for dehydration increases rather rapidly.

Available desiccants

Several good desiccants are available to the plant operator which, when installed, properly "seasoned," and protected from damage by free liquid water, will give an excellent service life under normal operating conditions.

We have found, in the case of solid desiccant plants with multi-bed towers, that a combination of the activated bauxite desiccant and the siliceous type desiccant give very satisfactory results. The best features of each desiccant are utilized by such a combination. For our single-bed towers, the selection is based on the nature of the service to which the bed is to be subjected.

Our glycol plants are of the older type and were designed for di-ethylene glycol and that is what we are still using. There is probably an advantage in tri-ethylene glycol because of its lower vapor pressure if a plant is designed to utilize this advantage.

Fig. 3 shows the recording dew point machine, which was developed by the Bureau of Mines. This instrument has proved extremely valuable in the control of plant operations. It is particularly valuable as a trouble locator, which permits the shortest possible "off stream" time of a plant when repairs or desiccant replacement are necessary.

By use of this instrument, the plant cycle time may be extended so that full saturation of the desiccant beds can be achieved. This results in fewer regeneration cycles per day of the desiccant material and assures a much longer service life for the drying media, since the life of the desiccant is a function of the number of regenerations to which it is subjected.

The instrument may be used to blend undehydrated gas with the dehydrated gas so that the resultant water content of the blend will meet the required specifications, thereby increasing the capacity of an existing dehydration plant, with the possible saving of additional investment and operating expense of an additional unit.

Saturation limits

Fig. 4 shows a chart from a recorder indicating how the beds in a unit have been taken to maximum allowable saturation limits before being switched, so that the maximum capacity of the desiccant may be obtained from the plant.

Fig. 5 shows a typical record of the control that can be achieved when blending wet and dry gases. This shows the uniformity of dew point that has been obtained over a period of one week. We do not have an instrument that does this blending automatically, but I see no reason why this instrument could not be readily adapted to such service when needed. The reading on this chart shows that the variation of water content was from 2.7 lb/MMcf to 3.3 lb/MMcf.

Pipeline People

L. R. ZITO has been named district manager of the newly opened west coast office of Tapecoat Co., Evanston, Ill. California, Oregon, Washington, Idaho, and Nevada will be served from the San Lorenzo, Calif., office.

L. R. Zito
Tapecoat

E. C. Rook
Blaw-Knox

E. C. ROOK has succeeded G. L. DIRKS as vice president and general manager of the Blaw-Knox Equipment Division, Pittsburgh. Mr. Rook recently retired as a captain in the U. S. Navy.

MORTIMER JORDAN has joined the Southern Natural Gas Co., Birmingham, in the newly created post of director of public relations. He was formerly with the University of Alabama where he served as assistant to the president for university development.

HENRY A. HOLBERSON has been elected vice president and general manager of Youngstown Metal Products Co., a subsidiary of the Youngstown Sheet & Tube Co., Youngstown, Ohio. He succeeds the late DAVID W. THOMAS.

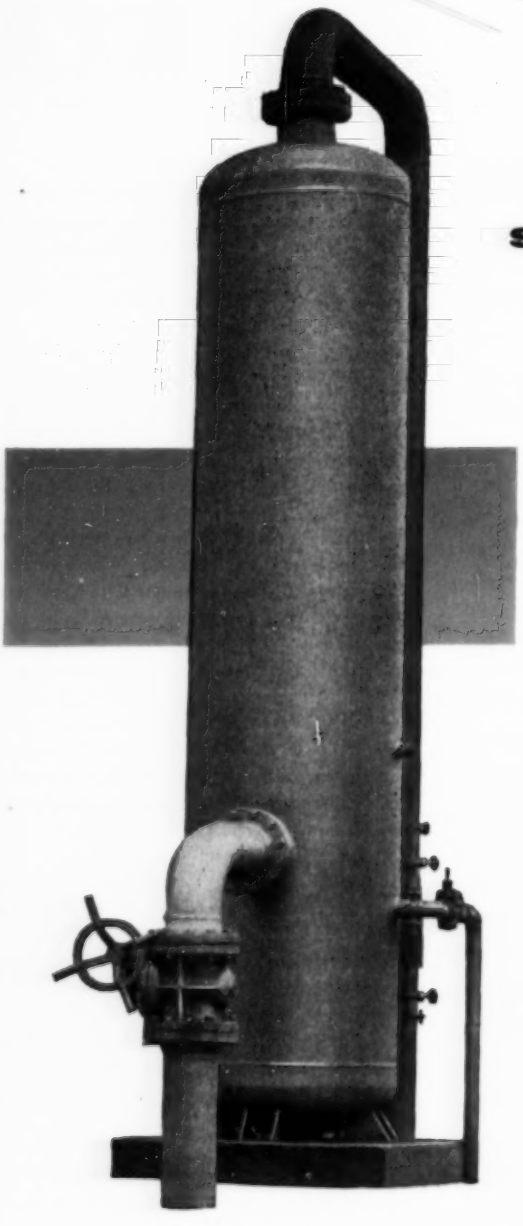
Hamer Valves Inc., Long Beach, Calif., has expanded the sales territory of TOM S. ANDREWS to include New Mexico, Arkansas, and Louisiana. He formerly covered only Oklahoma, Kansas, and north Texas.

HENRY A. BOURNE, manager of the Midcontinent sales office of Republic Steel Co. in Tulsa, has been promoted to manager of the Pacific coast sales division with headquarters in Los Angeles.

CLAUDE M. SMITH, formerly with West Penn Electric Co., has joined the Fluor Corp. Ltd., Los Angeles, as manager of sales-utilities.

LeRoi Co., Milwaukee, has promoted RAY H. RODOLF to the post of general manager, compressor division, and HERSCHEL V. HIATT, general manager, engine division. The company has also named JACK E. HEUSER vice president in charge of sales.

MILAM P. HARE has been appointed district salesman in Houston for Master Tank & Welding Co., Dallas.



Blaw-Knox gas cleaner saves $3600 a year in maintenance costs

For over 31 years, the compressor station illustrated above pumped an average of 3 million cubic feet of gas per day from Western Pennsylvania wells. During that time, damage to compressor parts from entrained dust cost the company $3600 a year.

This figure does not include costly damage to meters and regulators in the distribution system, the revenue lost as unmeasured gas or the expense of cleaning out service lines and pilots.

Since 1942, when a Blaw-Knox Gas Cleaner was installed, maintenance resulting from pipeline dust has been negligible. Dust removed from the cleaner has averaged 11 bushels every three months, or over 30 pounds a day.

Field tests repeatedly have shown that outlet gas from Blaw-Knox Gas Cleaners is free of dust, regardless of the quantity or particle size entering the equipment.

The low maintenance cost and remarkable efficiency of Blaw-Knox Gas Cleaners are the result of a unique oil scrubbing principle, coupled with continued design improvement based on careful field and laboratory study.

When you buy, specify Blaw-Knox. You'll be sure to remove even the finest particles of dust.

The new Blaw-Knox Bulletin No. 2450 contains complete information. Write for it.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Gas Equipment Department
Pittsburgh 38 Pennsylvania

PIPELINE NEWS

American Louisiana

(Continued from Pipeline Cover)

American Louisiana reported that four major suppliers had indicated they would submit to FPC regulation by Dec. 1. The four-Superior, Stanolind, British-American, and Kerr-McGee—can provide an adequate supply for the entire demand for 16 years, an American Louisiana spokesman said.

The commission concurrently issued a certificate to Texas Gas Transmission Corp., Owensboro, Ky., authorizing it to build facilities to supply American Louisiana with part of its natural gas requirements. The Texas Gas certificate also is conditioned to require that the company cannot commence construction until the suppliers from which Texas Gas purchases natural gas have complied with FPC Order 174-A (prescribing rules to govern independent producers) where applicable.

The American Louisiana project, as authorized by the FPC, will include a total of about 1,172 miles of pipeline. The system will originate at North Tepetate, La., and extend to a terminus at Detroit, Mich. The company also proposed to build 117 miles of line extending from a point on its proposed system near Payne, Ohio, to the Bridgman, Mich., area. The commission did not authorize this portion of the system pending conclusion of the proceedings on related applications by two affiliates of American Louisiana—Michigan-Wisconsin Pipe Line Co., and Michigan Consolidated Gas Co., both of Detroit. The three companies are subsidiaries of the American Natural Gas Co. The 117 miles of line would connect with Michigan-Wisconsin's system at Bridgman.

The total overall cost of the American Louisiana system is approximately $130 million, including the portion of the line not authorized by the FPC.

Texas Gas will construct about 48 miles of pipeline paralleling sections of its existing system between its Lake Cormorant, Miss., compressor station and its Slaughter, Ky., compressor station. Estimated cost is $4,281,135. Texas Gas will supply American Louisiana with an average of 51 MMcf of gas per day, or 18,615,000,000 cu ft per year of American Louisiana's total annual requirements of 111,946,000,000 cu ft.

American Louisiana plans to supply 100 MMcf of gas per day to Michigan-Wisconsin and 200 MMcf of gas per day to Michigan Consolidated. Hearings on the applications of the latter two companies have not been completed. The final disposition of American Louisiana's capacity will be the subject of a further FPC order.

Both the American Louisiana and Texas Gas certificates are conditioned to require the companies to file rate schedules satisfactory to the commission not less than 60 days prior to the commencement of service. American Louisiana must also file a plan of financing satisfactory to the FPC at least 30 days prior to starting construction of its project.

American Louisiana's gas purchase contracts provided that the sellers could terminate them on or after Oct. 1 if the company had not secured its FPC certificate. Pointing to the "crying demand" for additional gas in the Michigan-Wisconsin area, the majority said that it did not believe that it "would be consistent with our responsibilities, during this transitional period" resulting from the United States Supreme Court decision in the Phillips Petroleum Co., case "for us to adopt any procedure for enforcing the mandate of the Phillips decision, which might result in a collapse of the American Louisiana project to the detriment of the public welfare."

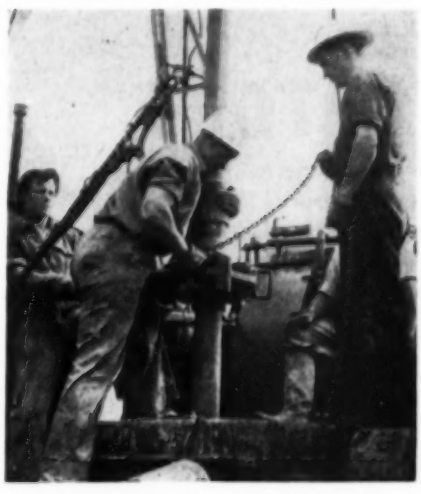
The majority pointed out that Michigan Consolidated has indicated and presented evidence that it can absorb the proposed rate of American Louisiana without affecting its existing rates, which are subject to the jurisdiction of the Michigan commission. The opinion also noted that the Michigan commission, as well as the City of Detroit, County of Wayne, Mich., and the Public Service Commission of Wisconsin, had actively participated in the proceedings and have strongly urged the issuance of a certificate to American Louisiana on the record at this time.

Chairman Kuykendall and Commissioner Digby, in their dissenting opinion, said they believe that a certificate cannot lawfully be issued to American Louisiana on the existing record. They said, however, that they would not be in favor of denying the American Louisiana and Texas Gas appications, but instead would issue an order setting forth the commission's views on the questions involved and affording an opportunity to the applicants to make further proof concerning issues not justified at this time. They also declared than an order of this character would afford the companies as much legal protection concerning their purchase contracts as does the action of the majority.

Questioning several aspects of the feasibility of the American Louisiana project, they asked how the commission could determine the design and capacity of the pipeline when the available gas supply, if any, of the company is unknown at this time. Further, they asked, since the available gas supply, the cost thereof, the design, capacity, and load factor of the pipeline are not known at this time, "how can we determine whether or not the project is feasible?"

Chairman Kuykendall and Commissioner Digby also questioned the soundness of the argument that it was necessary that American Louisiana have a certificate by Oct. 1 in order to hold its suppliers to their contracts. They declared that if the suppliers by their conduct, have prevented the applicant from performing under its contracts with them, "then they, the suppliers, cannot escape their contractual responsibility by claiming the applicant has defaulted."

The dissenting opinion also expresses the belief "that the document which is being issued to the applicant is not, in law, a certificate of public convenience and necessity."



Drillers at work as part of the $2.8 million to be spent by the British gas council in a search for gas over the next five years. Gas has already been located in Sussex, England, and the D'Arcy Exploration Co. is at work there with a mobile laboratory that is parked at the site.

Westcoast appeals for review of Northwest case

Westcoast Transmission Co., loser in the battle to serve the Pacific Northwest with natural gas, has asked the U. S. Circuit Court of Appeals in Philadelphia to review the FPC's decision which authorized Pacific Northwest Pipeline Corp. to serve the area with gas from the San Juan basin area.

Westcoast proposed to serve the area with gas from the Peace river area of British Columbia and northern Alberta.

Work to start soon on largest municipal system

Clearing the way for an immediate start of construction in southeastern Alabama for what is described as the largest municipal natural gas system in the United States, a $19 million revenue bond issue was sold by the Southeast Alabama Gas District last month to an investment banking syndicate.

The project will provide natural gas for the cities of Andalusia, Dotham, Troy, Abbeville, Brundidge, Elba, Enterprise, Eufaula, Fort Deposit, Greenville, Headland, Luverne, Opp and Ozark. Gas service also

will be made available to cities along the gas system right of way, including Rutledge, Glenwood, Brantley, New Brockton, Newville, Midland City, Pinckard, Newton, Seale and Gantt. (See Gas, April 1953.)

Mayor Tracey B. Wilder of Andalusia, who heads the sponsoring district, said recent dismissal of a law suit before the Alabama Supreme Court paved the way for financing and construction of the project. He said 16,000 applications already had been received from customers desiring service.

A 10-in. outlet will tap the line of Southern Natural Gas Co. west of Wetumpka. The new line will carry the natural gas south to Andalusia, west to Dotham and north to Phenix City, where it will again be attached to the main line. The U-shaped arrangement provides more pressure for users, it was explained.

The 4½% revenue bonds are scheduled to mature in 1989, with 75% of the revenue from the gas system to go to pay off the bonded indebtedness until that date or until the bond issue is liquidated sooner. Engineers estimated the bonds can be paid off by 1974.

Mayor Wilder said the project has received enthusiastic support from many municipalities in the area because of the prospect of attracting new industries. Heretofore, fuel in most of these cities has been wood, coal, butane gas and oil.

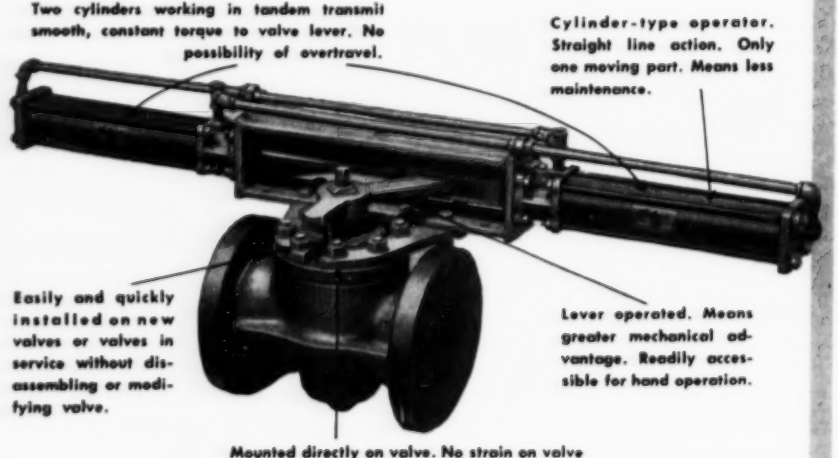
Five dollar deposits were required with each of the 16,000 applications already received for service. Similar applications will be accepted for about 60 days, Wilder said, after which each customer will be required to pay a connection cost estimated at $75. The communities involved have a total population of more than 100,000

Business policies of the municipal corporation sponsoring the project will be determined by a board of directors composed of 14 members—one from each of the member municipalities. Management consultants will be employed to perform acutal operation of the system.

The service area, lying south and east of Montgomery, covers about one-eighth of the area of the state.

Wilder said natural gas will be purchased by the municipal corporation from Southern Natural Gas Co. in accordance with an order of the Federal Power Commission, which was secured in May 1953. (Docket G-1907).

Here is a Simple, Dependable, Safe Plug Valve Operator


Two cylinders working in tandem transmit smooth, constant torque to valve lever. No possibility of overtravel.
Cylinder-type operator. Straight line action. Only one moving part. Means less maintenance.
Easily and quickly installed on new valves or valves in service without disassembling or modifying valve.
Lever operated. Means greater mechanical advantage. Readily accessible for hand operation.
Mounted directly on valve. No strain on valve or stem. No special manifolds necessary.

Ledeen
VALVE ACTUATORS

Ledeen Valve Actuators have no rotating motors, gears, bearings, clutches or other fast-moving parts. They are straight-line, cylinder-type operators — simple, highly efficient and easy to control. Operated by high or low pressure, air, gas, oil or water. Suitable for automatic safety shut-off installations, blow-downs, instrument control and numerous other proved applications.

Write for Bulletin 3020

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC
PUMPS & BOOSTERS

Ledeen Mfg. Co.
1608 So. San Pedro St.
Los Angeles 15, Cal.

Idaho Power changes plans due to "uncertainty"

Because of the "uncertainty regarding the level of rates," the Idaho Power Co. has decided not to appply to the Idaho Public Utilities Commission for a certificate to distribute natural gas in Idaho. Several firms have applied for franchises to distribute gas from the Pacific Northwest Pipe Line Corp.'s line.

In its letter to the PUC announcing its intention, Idaho Power said " . . . our company has been engaged in extensive engineering and economic studies relating to the distribution of natural gas, when available, on an area-wide basis in southern Idaho, at such uniform rates as would make that service attractive to all potential users.

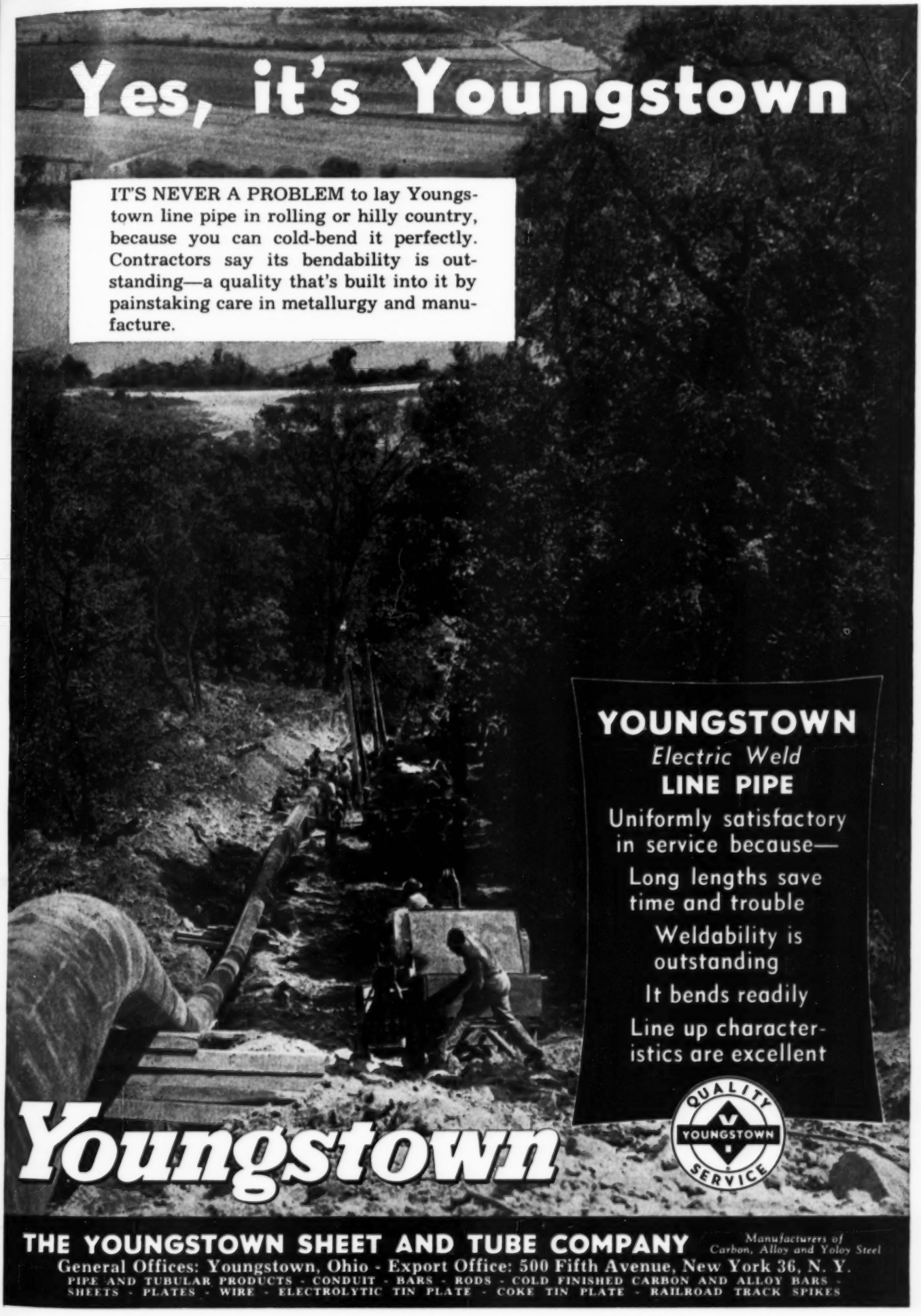
"As a result of those studies . . . and because of the uncertainty regarding the level of rates at which a wholesale supply of gas will be available . . . initially and in the future, we have concluded that we will not make application to your commission for a certificate . . . "

Natural Gas Pipeline to increase supply

Natural Gas Pipeline Co. of America has contracted for 50 MMcf of gas daily with a group of independent oil and gas operators in Wise county, Texas.

To take the gas from the field, Natural Gas will build a 370-mile, 20-in. line from the field through southwestern Oklahoma to Amarillo, to tie in with the company's transmisison line to Chicago.

Estimates of geolgists place the field's reserves at about 500 billion cu ft with a possible potential of 650 billion. The line will have a capacity to deliver 150 MMcf daily.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Two rate increases suspended by FPC

Recently the FPC suspended until Feb. 1, 1955 a proposed $1,147,000 rate increase by Colorado-Wyoming Gas Co., Denver, and the $10,702,000 increase requested by Natural Gas Pipeline Co. of America, Chicago.

The FPC has also allowed tariff sheets filed by Northern Natural Gas Co., Omaha, to take effect to provide for a $315,000 annual reduction in wholesale gas rates to reflect the invalidation of the Texas gathering tax. In another action, the commission accepted tariff sheets filed by United Natural Gas Co., Oil City, Pa., to pass along a decrease in the rates it pays to one of its gas suppliers, New York State Natural Gas Corp.

The commission has approved a settlement, including withdrawal by Tennessee Gas Transmission Co., Houston, of its proposed $13,616,000 or 10.3%, annual increase, which had been under suspension since last June 1. The settlement also provided that TGT must refund to its customers any amounts it may receive as refunds as the result of the final disposition of other pending rate proceedings.

Requests for increases include that of Southern Natural Gas Co., Birmingham, seeking a $7,018,000 hike that would affect 80 wholesale customers in Alabama, Georgia and South Carolina.

Hope Natural Gas Co., Clarksburg, W. Va., which had applied for a $3,814,753 increase, has been ordered to reduce this amount and file a new rate schedule reflecting the lower allowed rate.

Four Georgia cities to get gas from Southern

Southern Natural Gas Co., of Birmingham, has been told by the FPC to supply natural gas to four cities in Georgia—Summerville, LaFayette, Trion and Dalton. (Dockets G-2386, et al).

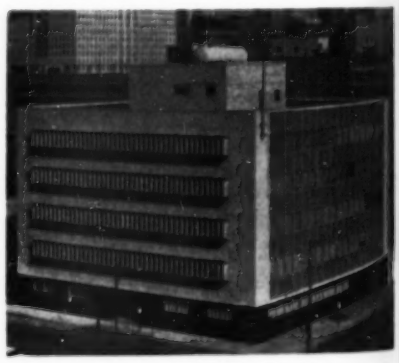
The cities of Summerville, LaFayette and Trion filed a joint application last March 8 requesting the FPC to direct Southern to esablish a physical connection near Rome, Ga., with facilities to be constructed jointly by the applicants, and to sell natural gas to them for local distribution within their respective service areas.

The three cities will construct a common transmission system of about 51 miles of pipeline at an estimated cost of $895,000. In addition, each city will construct its own distribution system, at an estimated cost of $750,000 for Summerville, $460,000 for LaFayette, and $180,000 for Trion.

Dalton filed its application last March 22. The city will build about 39 miles of pipeline extending from the connection with Southern's system to its proposed distribution system in Dalton. Total estimated construction cost is $2,940,000.

Pipeliners must consider new economic factors

The approach of the delivered price of natural gas to that of coal and oil has compelled gas pipeline companies to give certain economic factors top consideration in designing transmission facilities, William B.



Gulf Interstate Gas Co. will occupy the major portion of the upper three levels of this five-story building in Houston. The structure, to be known as the Gulf Interstate building, contains 50,000 sq ft of office space. The company acquired it on Sept. 30.

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Pipeliners filling patch pad device with hot enamel (left). The handy coating repair tool is lifted into position so that the "patch" covers the damaged area (right).

Patch-pads used to repair skid marks in protective coating

THE desired uniform thickness of pipeline enamel cannot be maintained on coated and wrapped pipe when it is necessary to rest the line on skids before the enamel has had time to cool and set. Usually, a discontinuity will be created where the coated surface of the pipe contacts the timber surface of the skids. These holidays require hand worked repair prior to lowering in if the corrosion prevention program is to be completely effective.

The Protecto Wrap Co. was given the job of working out a solution to the skid mark troubles experienced by El Paso Natural Gas Co. Members of both organizations put their heads together and produced an economical "patch-pad" that makes a quick, practical repair. The tool used is merely a ¾-in. pipe frame with metal saddles welded on in such a manner that they are symmetrical with the circumference of the pipe. The saddles form a cradle or reservoir for hot enamel. Two men can apply the patch-pad by use of the handles formed by the pipe frame.

The first step in application is to shape a piece of pipeline felt and line the cradle with it. Experience has shown that it is best to use 30-oz. felt, which is, generally speaking, heavier than that used for the original wrapper. Hot enamel that meets the same specifications as that on the pipeline is poured into the cradle. Then, two men lift and hold the pad in place so that the damaged area is completely covered. In a short time, the enamel sets enough to support the weight of the patch. The next skid-produced scar in the coating is then repaired.

The illustrations point out the simplicity of the tool and the ease with which the patch-pads are used to restore skid marked protective coatings to their original efficiency.

The patch pad is held in place until the enamel sets enough to support its weight.

Poor, of the New York firm of Ford, Bac & Davis, told the convention of the Amer can Society of Civil Engineers last mont Forthcoming code revision for pressure pip ing was another factor listed.

"The economics of natural gas transmi sion are, each year, becoming competitiv . . . as the delivered price of gas approaches or equals, the price of competitive fuels . . said Mr. Poor, "because of the escalation o the field price of gas, increased steel prices increased costs of rights-of-way, and more stringent control by state authorities.

"Basically, the economic factors affecting engineering design appear to be the characte of the market to be served and development of the load factor; availability and economics of gas storage fields; economic determina tion of line size versus ultimate installed horsepower; and careful predetermination o the pipeline location," he continued.

"Since the cost of owning and operating a natural gas pipeline system is nearly con stant . . . the cost of transporting gas on a unit volume basis is almost inversely propor tional to the load factor," he said.

"Only underground storage is sufficiently low in cost to permit economic termina storage in sufficient quantities to level an nual load variations . . . The cavern storage method through mining operations offers promise where natural reservoirs are not available.

"Today there are in operation storage fields having a combined capacity of 120 billion cu ft and economically serving mark ets as remote as 300 or more miles."

Montana Power seeks more Canadian gas

Supplemental supplies of Alberta gas are being sought by the Montana Power Co. Butte.

The company proposes (Docket 6-2805 to import gas produced from fields in the Pakowki Lake area in southeastern Alberta The gas would be produced or purchased by Canadian-Montana Co. Ltd., a wholly owned subsidiary of Montana Power. It would then be delivered to Canadian-Montana Pipe Line Co., another wholly owned subsidiary, which would make delivery to Montana Power through existing facilities at the U. S.-Canadian boundary.

The commission in February of 195 authorized Montana Power to import up to 40 MMcf of gas daily and a maximum of 10 billion cu ft of natural gas annually from Canada, to be used exclusively to render service to the Anaconda Copper Mining Co. That authorization expires April 7, 1956.

Montana Power said that the Alberta Petroleum and Natural Gas Conservation Board recently issued a new 20-year permit to Canadian-Montana Pipe Line authorizing the export of a maximum of 100 MMcf of gas per day and up to 20 billion cu ft per year. These volumes include the volumes heretofore authorized.

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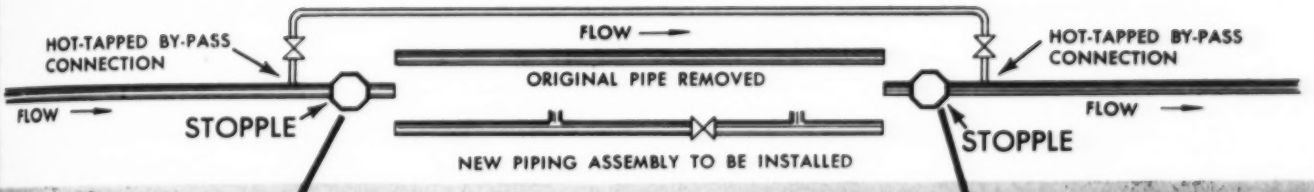

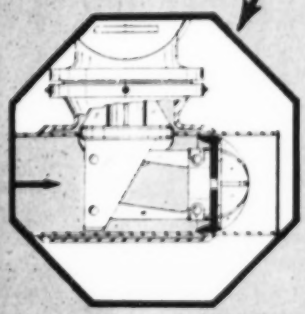

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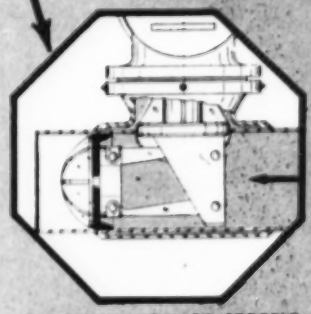

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Iowa okays Northern's underground storage plan

In authorizing Northern Naural Gas Co., Omaha, to construct a 9660-acre underground gas storage reservoir north of Redfield in Dallas county, the Iowa Commerce Commission attached several conditions designed mainly to protect interests of property owners involved and provide for safety.

Storage is limited by the order to 50 billion cu ft unless special permission is given.

Conditions attached to the commission's approval of the $11 million project included: the company shall avoid undue interference with normal agricultural pursuits; in drilling and storage, adequate provision shall be made to prevent gas leaks; the company shall maintain an observation well to detect escaping gas; the storage shall be limited to 1000 ft below the surface of the land; and that water used for gas cooling operations shall be disposed of so as not to interfere with the drainage.

Northern said it had agreements for the project with owners of 9034 of the 9660 acres concerned. Although the commission gave the company the right to acquire the area needed by condemnation, Northern expressed hopes it would not need to resort to such action.

The storage area will have a maximum width of 3¼ miles and a length of about 5¾ miles. The gas will be stored at a depth beginning at 2700 ft. Eleven or twelve wells will be drilled for injection and withdrawal. Northern estimates the project will permit service to about 140,000 additional domestic customers.

Texas Eastern to add new customer, hike deliveries

Hearings were to commence Oct. 12 on proposals by Texas Eastern Transmission Corp., Shreveport, to sell natural gas to one new customer and to increase deliveries to 12 existing customers, all on a short term and temporary basis.

Texas Eastern is seeking authority to sell additional gas under its short term service rate schedules to National Gas & Oil Corp. and Public Service Electric and Gas Co., for the period from Nov. 1, 1954, through Oct. 31, 1955.

Texas Eastern proposes to sell gas under its winter peaking service rate schedules to the following existing customers from Nov. 1, 1954, through March 31, 1955: Arkansas Missouri Power Co. Associated Naural Gas Co., City Gas Co. of New Jersey, Illinois Electric and Gas Co., National Gas and Oil, New Jersey Natural Gas Co., Philadelphia Electric Co., Philadelphia Gas Works, Public Service Electric and Gas Co., and Waynesburg Home Gas Co.

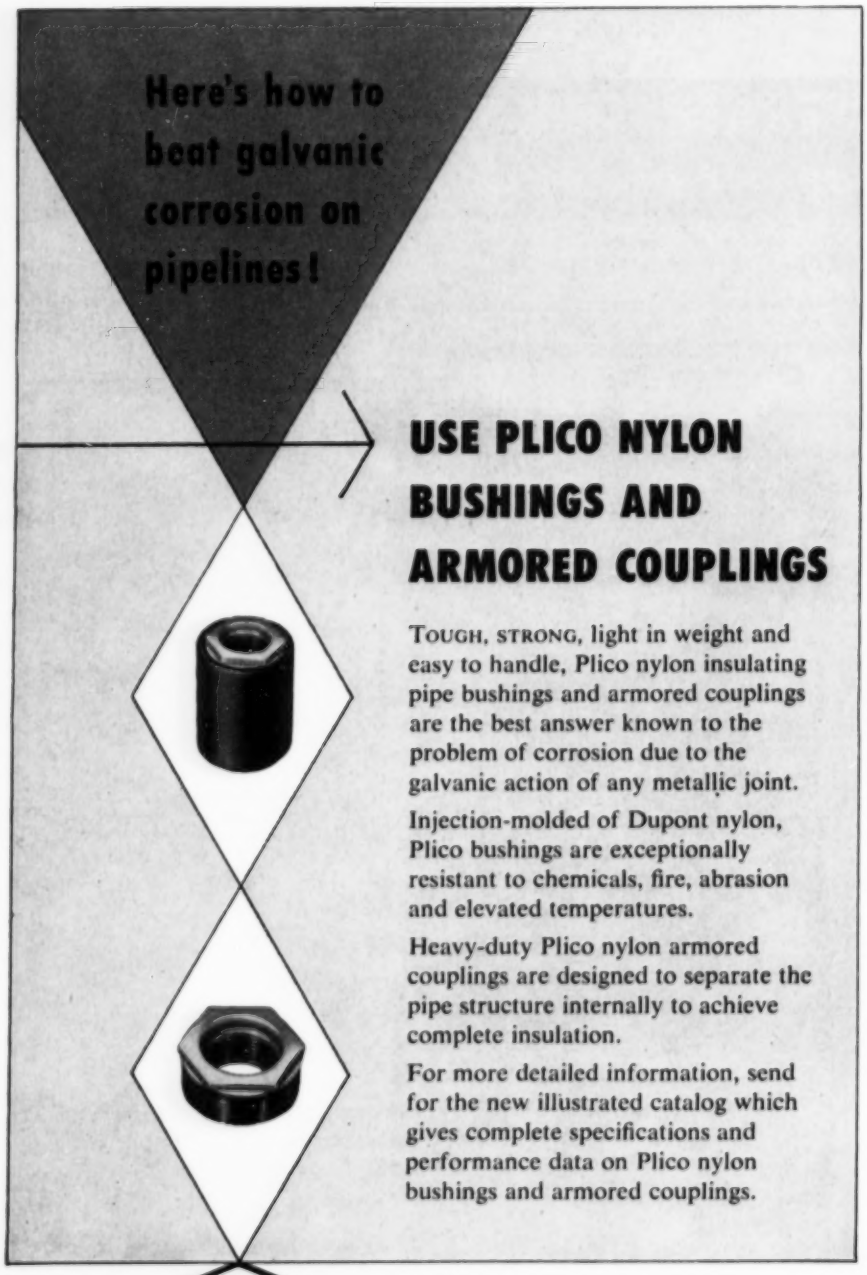
The other application was filed jointly by Texas Eastern and Transcontinental Gas Pipe Line Corp., Houston. It requests authorization for Texas Eastern to sell 1.5 MMcf of gas per day to Elizabethtown Consolidated Gas Co., for the period Nov. 1, 1954, through March 31, 1955, under its winter peaking service rate schedules. Transcontinental, which now serves Elizabethtown Consolidated, would receive delivery of the gas from Texas Eastern and then redeliver it to Elizabethtown. Texas Eastern does not have a connection with Elizabethtown.

Large diameter pipe to be produced in Utah by USS

Consolidated Western Steel division of United Steel Corp. will construct a steel pipe manufacturing plant near the Geneva Works of U. S. Steel's Columbia-Geneva Steel division near Provo, Utah. The plant will produce electric weld pipe used for transmitting natural gas, petroleum products, and water.

Pipe mills for large diameter expanded line pipe in sizes from 20 to 36 in., and facilities for producing small diameter, resistant-welded line and water pipe, will be installed in two 980-ft bays at the 117-acre site. Other principal structures will be an office building and a building to house equipment for the coating and wrapping of small diameter pipe.

The new Utah plant will replace line pipe manufacturing facilities at South San Francisco, Berkeley, and Los Angeles. At Los An-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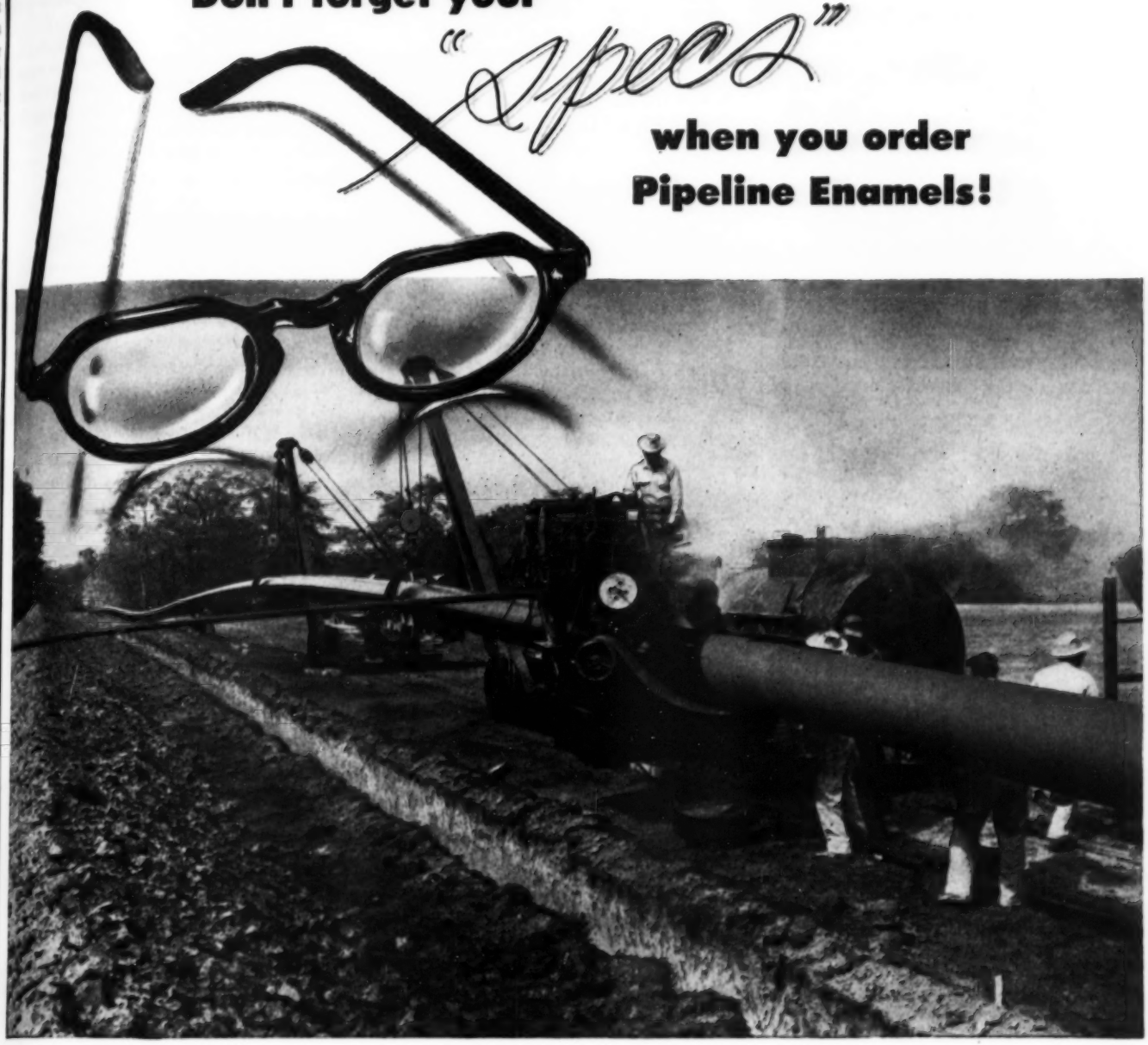

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HOT DOPE

Straight from the Kettle on PIPE PROTECTION

★

By Boyd Mayes

● Recently saw about the most interesting map of the Gulf Coast that I reckon anybody would care to see. While it didn't highlight the towns and vacation spots—it was lit up like the old fashioned Christmas tree with *red lines and dollar marks.* Every red line was an important deal to all of us—because every line on that map represented the pipe lines running in every direction from Texas and Louisiana . . . and represented literally barrels of dough! Yes, sir, pipelining is really big business, and it sure gave us a feeling of pride to know that it had been our privilege to have contributed to the building of many of those main lines through our work and equipment. Which reminds me of what 'ole Zeke used to say, ". . . . if a man ain't proud of his work—he ain't much fitten for it!"

We think the boys who did all that pipeline laying and stringing shown on that map are sure entitled to be proud . . . for they have helped make history. To meet their requirements we keep the best in men and equipment for coating and wrapping pipe; we've been "putting permanence in pipe" for over a quarter of a century.

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geles and South San Francisco only line pipe manufacturing facilities will be affected by the new plant.

Louisiana's purchaser act to be challenged

A fine of $350 against the Arkansas Louisiana Gas Co. for violating the 1918 gas common purchaser act, which says that natural gas must be purchased "ratably" and "without discrimination" from its owners in a gas field, will result in the first court test of that act.

Immediately after the imposition of the fine by District Judge McClendon, company attorneys said they would appeal to the state supreme court. The company contends the act violates both the state and federal constitutions and has been superseded by the 1940 state conservation statutes.

The case arose when six royalty owners complained to the Homer (La.) district attorney that Arkansas Lousiana was paying smaller price for gas to one group than to the other.

Trans-Canada completes first link of gas line

The first link of Trans-Canada Pipe Lines' 2200-mile line to bring natural gas to central and eastern Canada by an all-Canadian route was nearing completion on Nov. 1. The first phase of the project consists of two river crossings and a 75-mile line from a manifold on the Canadian side of the Niagara river to a point about 20 miles west of Toronto, where the line will be integrated into the facilities of Consumers Gas Co.

The crossing of the Niagara river linked the Trans-Canada line with that of Tennessee Gas Transmission Co., which will supply gas until the line from western Canada is completed. The Niagara line will then carry Alberta gas into southwestern Ontario, and may also carry surplus gas for sale in the United States.

Some 2100 ft of 20-in. pipe was used for each of two crossings. Pipe was first welded into 700-ft strings and then pulled across the river through 7-ft deep ditches. Pulling was done by a winch on Trans-Canada's right-of-way. The crossing took place near Lewiston, N. Y.

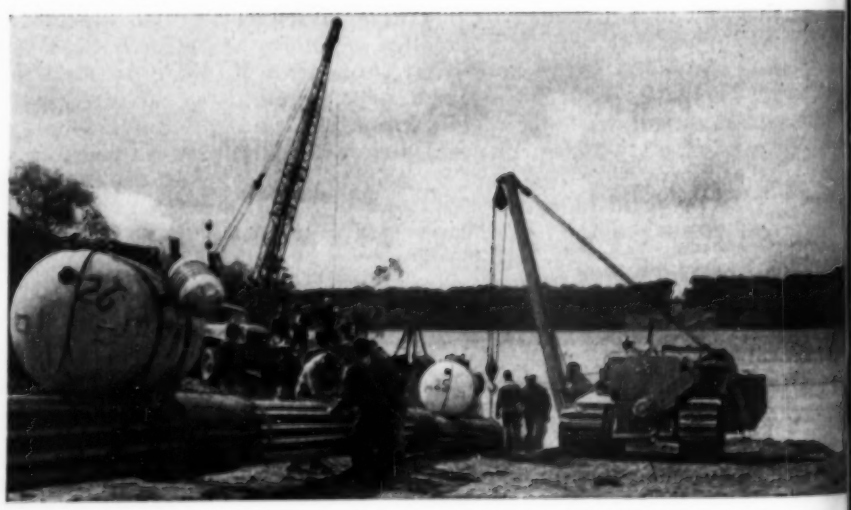
Pipeline Notes

Cities Service Gas Co., Oklahoma City, has requested authority from the FPC for the construction of new natural gas facilities in Anderson county, Kan., to increase the deliverabilities from three storage areas (Docket G-2542). The project includes three 1350-hp units at its Welda compressor station; 6 miles of 4-, 6-, and 16-in. pipe in the Colony, South Welda, and North Welda storage fields; approximately 55 injection and withdrawal wells in these fields. Total estimated cost of the project is $1,426,690.

Ohio Fuel Gas Co., Columbus, has asked the FPC for authorization to construct 10.6 miles of 20-in. pipeline and an 880-hp compressor station to help improve its underground natural gas storage operations in Ohio (Docket G-2522). The line would be located in Hocking and Fairfield counties in the company's Benton storage area. The new compressor station will be built in the Guernsey county storage area.

Pacific Metal Co., Portland, Ore., has been appointed a distributor of Tube-Turn aluminum welding fittings and flanges, according to Tube Turns, Louisville, Ky.

Sheepbridge Engineering (Canada) Ltd., Guelph, Ont., has been licensed to manufacture cast steel industrial valves for the Ohio Injector Co., Wadsworth, Ohio. Valves will be marketed in Canada through authorized



The first 700-ft string of pipe has been paid out into the Niagara river and the second has been welded to it. Wooden protective slats are being wrapped around the welded area to protect it during the pull. Trans-Canada's right-of-way on the Canadian shore is shown by the break in the trees in the background.

OIC distributors located in strategic positions to provide customers with a full range of services.

Stockholders of Tennessee Gas Transmission Co. and its affiliate, Tennessee Production Co., have voted approval of a proposal to merge the production company with and into the transmission company. It is expected that the various legal procedures required, including approval of the FPC, will be completed in time for the action to become effective by Dec. 31.

Northeastern Transmission Co., a subsidiary of Tennessee Gas Transmission Co., Houston, has been absorbed by the parent company. The merger, carried out with the approval of the FPC, brings 533 miles of gas pipelines in Massachusetts, Connecticut, New Hampshire, and Rhode Island into the TGT system.

Texas' attorney general, John Ben Sheppard has told gas suppliers that sales to the farmers in the North Panhandle area for their irrigation pumps will be exempt from the state's gross receipts tax on gas utilities. Gas utilities must pay .484 of 1% to 1.66% of their gross receipts as taxes.

Alabama-Tennessee Natural Gas Co., Florence, Ala., has requested authority (Docket G-2534) to construct about 25 miles of pipeline, an additional 350 hp in compressor capacity, and a new meter station on its natural gas transmission system in Alabama and Mississippi. Total estimated cost of the construction is $808,450.

Progress Reports

NEW CONSTRUCTION PLANNED

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2542 for construction of 1350-hp units at its Welda compressor station; 6 miles of 4-, 6-, and 16-in. pipe in the Colony, South Welda, and North Welda storage fields; and to drill injection and withdrawal wells in these 3 fields.

CITIES SERVICE OIL CO., Oklahoma City. Dockets G-2569 and 2570 for 15½-mile, 16-in. line to transport gas purchased from Signal Oil Co. in Carter county, Okla., to existing facilities in Garvin county.

NATURAL GAS PIPELINE CO. OF AMERICA, Chicago. To build 280-mile, 20-in. line from Wise county, Texas, through southwestern Oklahoma to Amarillo to transport additional quantities of gas.

OHIO FUEL GAS CO., Columbus. Docket G-2522 for 10.6-mile, 20-in. line and an 880-hp compressor station. The line would be in the company's Benton storage area, the compressor station in Guernsey county.

CURRENT CONSTRUCTION

ARKANSAS LOUISIANA GAS CO., Shreveport. Docket G-2307 for 129 miles of 6⅝- to 24-in. line in 12 sections, and 10,500-hp compressor station on its system in Arkansas, Louisiana and Texas.

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TRANSMISSION LINES
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ATLANTIC SEABOARD CORP., Charleston, W. Va. Docket G-2286 for 116.6 miles of 26-in. line in five sections paralleling portions of existing system and addition of total of 4400 hp at two existing and one new compressor station. Western Pipe Line Constructors Inc. contracted for 45 miles of 26-in. from Clendenin to Walkersville, W. Va. Approximately 50 miles complete.

OHIO FUEL GAS CO., Columbus. Docket G-2408 for 24.5-mile, 20-in. line in Richland and Crawford counties, Ohio, to enable it to transport additional gas from underground storage.

OHIO FUEL GAS CO., Columbus. Docket G-2288. Contracts let: 13.3-mile, 16-in. N. Baltimore to Bowling Green.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-2102 to build about 200 miles of 34-in. mainline loops and add 2500-hp compressor capacity to company's 500-mile Topock-Milpitas line. Remains: Associated construction of 7.2-mile, 30-in. and 34-in. and 1.9-mile, 22-in. and 24-in. between Milpitas and Irvington under contract to M&M Construction Co. for construction in 1954.

SOUTH GEORGIA NATURAL GAS CO., Birmingham, Ala. Docket G-1915 for 368-mile, 12¾-in. line beginning at connection with Southern Natural line in Lee county, Ala., extending southeast to serve new communities in Georgia and Florida.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907. Construction on 150 miles of 18-in. and 4400-hp station remain for completion in 1955.

SOUTHEAST ALABAMA GAS DIST., Birmingham. A "U" shaped system of about 330 miles to serve 24 communities in southeastern Alabama from connections with Southern Natural.

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1969 for permission to carry gas for Iroquois Gas Corp., Buffalo, to export gas to Niagara Gas Transmission Ltd., Toronto, and to construct 904 miles of line—571 mile, 30-in. from Kinder, La. to Portland, Tenn.; 63 miles of 26-in. loop in Ohio; 45 mile, 20-in. line from Buffalo to U. S.-Canadian border; 58 mile, 20-in. line from Gulf Coast to Kinder station; and 102 miles of laterals in Texas; 17,520 hp additional at existing stations; 6600 hp in one new station. Contracts let to Morrison Constructors Inc., Anderson Brothers Corp., Houston Contracting Co., Oklahoma Pipe Line Constructions, Western Pipe Line Constructors Inc., and Panama-Williams Co. for Kinder, La. to Portland, Tenn. line; H. C. Price Co. for the Ohio loop lines; and Bechtel Corp. for spur line from TGT system to Canadian border. All spreads working on the Kinder-Portland line and 500 miles have been lowered in. Ohio loop about two-thirds complete; Niagara spur about 90% complete.

TEXAS EASTERN PENN-JERSEY CORP., Shreveport. Docket G-2341 to construct 265 miles of 24-in. line from Oakford storage field (Pa.) to Texas Eastern Transmission Co.'s Lambertville, N. J., compressor station; a 3300-hp compressor station near storage field. Construction substantially completed and hydrostatically tested. Work nearing completion on construction and testing of compressor station. Entire project on schedule and ready for operation by Nov. 15.

TRUNKLINE GAS CO., Houston. Docket G-2402 for two 24-in. Mississippi river crossings in the Greenville, Miss. area. Also 26-in. interconnecting lines to link new crossing with company's system. Missouri Valley Dredging Co. at work on job. Completion expected Dec. 15.

UNITED FUEL GAS CO. and CENTRAL KENTUCKY NATURAL GAS CO., Charleston, W. Va. Docket G-2285 for construction of a 4400-hp compressor station at its storage pool X-59 in Jackson county, W. Va. Also 59 miles of line and 6000-hp compressor station. Contract let to H. C. Price Co. for 57 miles of 30-in. More than 50 miles completed.

APPROVED

AMERICAN LOUISIANA PIPE LINE CO., Detroit. Docket G-2306 to construct 1289 miles of line—30-in. from North Tepetate, Acadia parish, La., to connect with Michigan Consolidated facilities near Detroit; 24-in. to feed into 30-in. line in Louisiana, also three 10,000-hp compressor stations. Not included is the 117-mile 22-in. line to extend from Payne, Ohio, to Bridgman, Mich., to connection with Michigan Wisconsin Pipe Line Co.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-2382 for 4 miles of line in Big Horn county, Wyo., metering station in Carter county, Mont., and 2640-hp compressor station in Big Horn county, Mont. Also 49 miles of line and additional 440-hp in compressor capacity on its system in Montana and South Dakota.

OHIO FUEL GAS CO., Columbus. Docket G-2491 for construction of 46 miles of line in Jackson, Vinton, Hocking, and Fairfield counties, and 3000 hp in additional compressor facilities at its station in Fairfield county.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo. Docket G-2433 for 575 miles of new line (294.6 miles approved), mainline loops, storage, lateral and gathering lines in Kansas, Missouri, Illinois, Indiana, Ohio, and Michigan and 113,000 hp in additional compression. Also includes develooment of Waverly storage field in Morgan county, Ill. Will increase peak-day delivery capacity from 970 to 1425 MMcf daily.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-2472. To construct 51 miles 20- and 16-in. line from Joaquin to Longview, Texas.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-2306 to build about 48 miles of 26-in. line between Lake Cormorant, Miss., and Slaughter, Ky. compressor stations; also one 1500-hp compressor station at Covington, Ky.

TRUNKLINE GAS CO., Houston. Docket G-2501 for 6350-hp compressor station at Edna, Texas.

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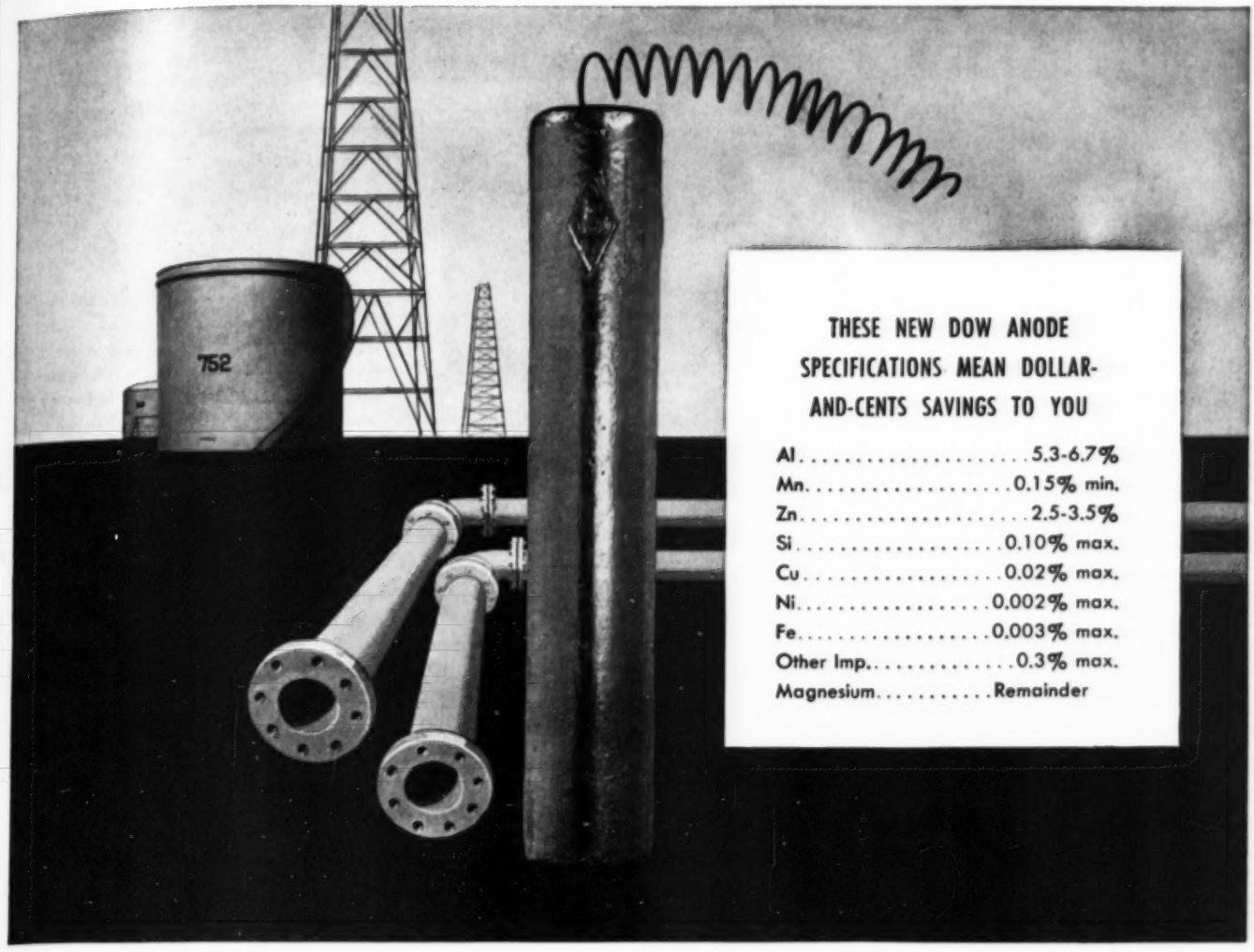

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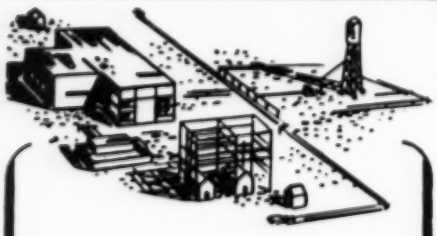

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New Products

For additional information on these products use coupon on p. 73.

20 Well Tester

The Oil Metering & Processing Equipment Corp.'s well tester is an oil and gas separator with an oil, water, and gas meter piped on it. It is used to measure the production from oil, distillate, and gas wells.

The well testers are available in any size and working pressure required. The de-gasing, defoaming, and separating element on the fluid inlet removes all gas from the oil that is not in solution in the oil. In addition, it eliminates foam by breaking the foam bubbles as they form. Complete separation of oil and gas is obtained with the element so that mist-free gas is discharged from the unit.

Specified sizes and types of oil and water meters, gas meters, liquid level controls, and other accessories required to fit in with established equipment standardization programs can be furnished.

Oil Metering & Processing Equipment Corp.

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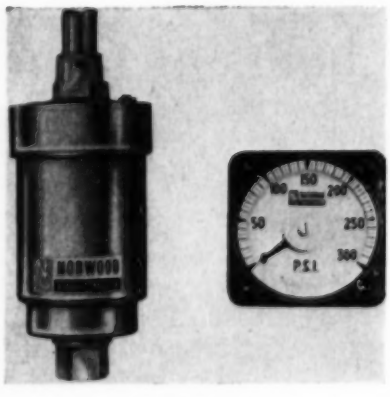

21 Measuring System

A new Norwood ElectroSyn pressure and temperature measuring system developed for industrial use is based on a signal generator which is a high resolution, electro-magnetic, rotary transducer with a linear output.

A complete Norwood ElectroSyn measuring system consists of a source of constant 60-cycle current, pressure or temperature detectors that can be directly mounted on a vessel or pipeline without additional support and an indicating long-scale meter mounted on a control panel remotely located from the detection points.

Since measurement signals can be transmitted electrically, the presence of explosive gases is not required in control rooms. Long range transmission may be accomplished using line or microwave facilities.

Control Engineering Corp.

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22 Conduit Valve

A new type of large diameter conduit valve, manufactured by Darling Valve & Manufacturing Co., is available in sizes 8 in. and larger. Positive seal is accomplished by means of a special sealant developed for pipeline service. The reservoirs within the valve contain enough sealant for about 50 operations of the valve. When it is closed, line pressure forces the sealant into a channel on the downstream face of the seat.

The only servicing required by the valves is periodic recharging of the cylinders with sealant.

Darling Valve & Manufacturing Co.

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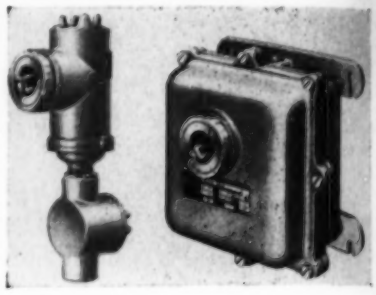

23 Condulets

Explosion-proof Condulets, consisting of a light source transmitter and a photoelectric tube receiver, now enable automation techniques to be employed at hazardous industrial or transportation areas. Introduced by Crose-Hinds Co., the system automatically activates or turns off lights, starts or stops motors, totals assembly line output, or controls a number of other electrical or electronic devices.

Light is provided by Type EPL Condulet; light detection by Type EPA 342 Condulet, a light-sensitive electronic control relay.

Crouse-Hinds Co.

■

Trade Literature

24 Valve Bulletin

Leedeen Manufacturing Co. has published a 16-page bulletin covering a complete line of standard 4-way hand-, foot-, power- and solenoid-operated valves. Also shown is a new line of pilot valves. Dimensions and weights, application diagrams, circuit dia-

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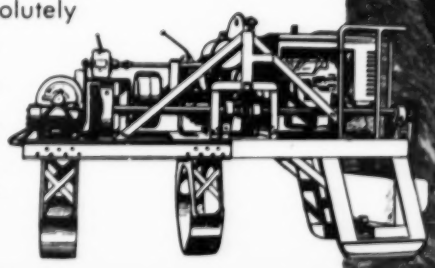

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Ledeen Manufacturing Co.

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25 Cooling Tower Booklet

"Cooling Water for Industry," available from Fluor Corp., explains in detail cooling tower construction and applications. The two-color, 36-page publication (CT-ID-0.002) describes Fluor's induced-draft cooling tower construction, with photographs, sketches, cutaway and exploded drawings.

Fluor Corp. Ltd.

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26 Emulsion Bulletins

Several catalogs are available from Black, Sivalls & Bryson Inc. (When ordering copies, use letter preceding description along with numbers of this notice.)

(a) Bulletin 31-03 describes the Model S emulsion treater, including a four-flow diagram and dimensional drawings.

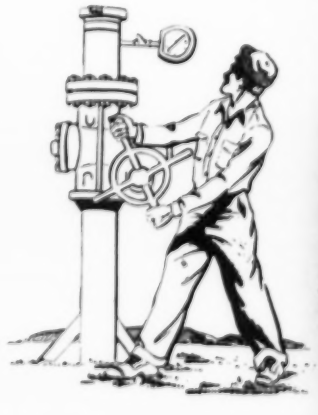
(b) Bulletin 31-04 describes the Model SCW emulsion treater with the same treatment as Bulletin 31-03 treats Model S.

(c) Bulletin 34-03 describes the BS&B glycol-type gas dehydrator for processing natural gas to pipeline specifications. This bulletin also includes a flow diagram and complete descriptions of units with rated capacities of 4 to 60 MMscfd and rated pressures from 400 to 2000 psi.

Black, Sivalls & Bryson Inc.

27 Gas Turbine Bulletin

Up-to-date operating characteristics and applications of General Electric's combustion gas turbine are described in a new bulletin that contains the latest information on the use of the turbine over the past few years in gas pipeline pumping service. Cutaway views, diagrams and pictures, together with charts and graphs on the turbine in gas pipeline service are included.

General Electric Co.

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